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UNITED STATES AIR FORCE TECHNICAL
ORDER ACQUISITION: WHAT ARE THE
PROBLEMS AND HOW CAN THEY
BE CORRECTED?

THESIS

Thomas D. Brown, Jr.
Captain, USAF

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AFIT/GLM/LSM/84S-6

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UNITED STATES AIR FORCE TECHNICAL ORDER ACQUISITION:

WHAT ARE THE PROBLEMS AND HOW
CAN THEY BE CORRECTED?

THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

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September 1984

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Preface

Our interest in the subject of Technical Orders (TOs) stems from our experience as operators and maintainers. We have both been frustrated by TOs that did not seem to be as good as they could have been, and the literature indicates that problems in the acquisition process are at the root of the problems. It was with an eye toward improving the end product that we undertook this research, in the hope that our efforts would benefit future TO users.

We were encouraged during our research by the enthusiasm of our advisor, Mr. Art Munguia. His interest was more than academic, and his knowledge of the TO acquisition process was a great asset to our research. We also benefited from the experience and judgement of our readers, Maj John Stibravy and Dr. Robert Weaver.

As with any project of this magnitude, we owe a great debt to our families for their patience and understanding during those times when we were laboring with this research. We sincerely hope our efforts are worthy of their sacrifice.

Thomas D. Brown, Jr.

Dennis R. Lyon

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Abstract

↗ The objective of this research was to identify problems with the acquisition of U.S. Air Force technical orders (TOs), and to identify changes to the TO acquisition process that could solve those problems.

A telephone survey of A.F. policy makers, program managers, integrated logistics support managers, and technical order acquisition managers was accomplished. The low experience level of personnel assigned to TO acquisition jobs, and coordination and communication problems were found to be the most significant problems of the technical order acquisition process. Inadequate manning and the need for earlier planning for TO acquisition were also found to be problems.

Five solutions to those problems were found to be valid and were recommended for implementation. They were the establishment of a centralized TO management agency, the establishment of TOs as a separate product, the development of "skeleton" documents, the development of a handbook outlining responsibilities, and the establishment of a TO acquisition management career field. The establishment of a centralized TO management agency was found to be the most needed solution. An implementation plan was presented for all recommended solutions.

←

UNITED STATES AIR FORCE TECHNICAL ORDER ACQUISITION:
WHAT ARE THE PROBLEMS AND HOW CAN THEY BE CORRECTED?

I. Introduction

General Issue

Technical Orders (TOs) are the key to the transfer of essential technical information from design engineers to operators and technicians. It is imperative that system Program Managers (PMs) initiate early planning and coordination for the acquisition of accurate, complete, and understandable TOs for all new weapon systems. A literature review shows that inadequate TOs have been acquired for several Air Force weapon systems. Inadequacies were found with the C-141, the B-52 G/H, and Inter-Continental Ballistic Missile (ICBM) maintenance or operator technical manuals. These inadequate TOs have resulted in increased program cost, reduced operational readiness, and increased operations and maintenance costs. In fact, from 1979 through 1983, investigations have identified logistics factors to be indirectly involved in 35 in-flight mishaps. Included as logistics factors are incorrect, incomplete, or inadequate operations and maintenance manuals or procedures. It must be emphasized that logistics factors were indirectly involved and were not listed as the primary cause of any of the 35 mishaps. The total repair costs for the 35 mishaps (1) was \$128,965,309. Interviews with technical order acquisition

experts have identified several problems within the technical order acquisition process that could result in even more inadequate TOs being acquired in the future. These technical order acquisition problems must be solved. The literature review and additional interviews with technical order acquisition experts show that recommendations to change the technical order acquisition process have been suggested by virtually every management level within the Air Force. Knowledge of the problems and the recommended solutions to those problems, as noted in this thesis, will assist the Air Staff and other managers who oversee the technical order acquisition process to make improvements in the future.

General Problem

Changes need to be made to the technical order acquisition process that will reduce the general systems management problems currently identified with that acquisition process and reduce the number of inadequate technical orders being acquired.

Background

Two questions must be answered before designing a research project aimed at identifying recommended changes to the technical order acquisition process that will solve technical order acquisition problems. The questions are aimed at identifying exactly which problems can be solved by

changes to the technical order acquisition process. The two questions are:

1. What technical order inadequacies are causing the user problems?
2. What are the problems identified by technical order acquisition experts?

1. Technical Order Inadequacies. A literature review indicates that research into user oriented technical order inadequacies has been conducted by the Air Force Human Resources Laboratory (2), Applied Science Associates, Inc. (3), and Air Command and Staff College students (4). Inadequacies have been found in seven technical order characteristics by one or more of the research projects. Those seven characteristics are:

1. Completeness
2. Accuracy
3. Relevance
4. Retrievability
5. Understandability
6. Compliance
7. Economy

When any of these characteristics are missing from technical orders, inadequate technical orders can result. The user can have problems performing technical order directed tasks when using inadequate technical orders. Technical orders are purchased through the technical order acquisition process. Inadequate technical orders are a

result of inadequacies within the technical order acquisition process.

2. Technical Order Acquisition Problems. Technical order acquisition problems have been identified through research sponsored by the Deputy Secretary of Defense (5), and the Air Force Logistics Management Center (6). As part of this research, members of the U. S. Air Force Centralized Technical Order Management Group Executive Committee (CTOM) were interviewed. The CTOM consists of the top technical order specialists from each of the major commands and is chaired by the top technical order specialist on the Air Staff. Other interviews were conducted with technical order experts from the Defense Material Specifications and Standards Office (7) and from the Air Force Systems Command Systems Program Offices (SPOs). The results of the research and interviews indicate that the experts believe that there are four major problem areas within the current technical order acquisition system. Those four problem areas are:

1. Technical order planning does not begin early enough in the acquisition cycle.
2. Coordination and communication between all agencies involved in the weapon system acquisition process is not adequate.
3. Manpower dedicated to technical order acquisition is not adequate.
4. Training and assistance for technical order acquisition personnel is not adequate.

The technical order experts have proposed recommendations aimed at solving these problems.

Scope of Research

For the purposes of this research, the term "technical order" will refer only to the technical manuals used to maintain or operate Air Force equipment. The problems and systems studied in this research project will be only those that have to do with maintenance or operations technical orders.

The major focus of this research is towards major Air Force weapon systems since the acquisition process for them is more complex than that for non-major systems; however, the problems being studied are not unique to major systems. The changes to the technical order acquisition process that will be recommended as a result of this research will be applicable to major and non-major weapon systems as well as to support equipment.

This research project will not attempt to examine every individual technical order related problem. The problems are too numerous. The individual problems have been examined, and four basic deficiencies have been found to be responsible for the majority of those problems. For example this research will not be directly targeted at problems with validation or selection of format; however, the four areas that will be examined have been found to contribute to many of the validation and format selection problems. The four basic deficiencies that will be examined in this research

project are the research questions that form the research objectives of this project.

The final limitation of this research project is the nature of the project. This research is exploratory in nature. As an exploratory project, no hypothesis will be tested. The intent of this research is to identify the nature of the problems with the technical order acquisition process and to identify potential changes to the acquisition system that can solve those problems. The changes that will be recommended as a result of this research will be hypotheses for future research.

Research Objectives

The objective of this research is to identify problems with the acquisition of U. S. Air Force technical orders, and identify possible changes to the technical order acquisition process that will solve those problems. This objective will be accomplished by examining four research questions.

Research Questions

The four research questions are:

1. How can technical order acquisitions be integrated into earlier phases of the weapon system acquisition cycle?
2. How can communication and coordination between technical order acquisition agencies and other acquisition agencies be improved?
3. How can manning and retention of technical order acquisition personnel be improved?

4. How can training and knowledge of technical order acquisition personnel be improved?

Answering these four research questions should result in recommended changes to the technical order acquisition system. Those recommended changes will in effect be hypotheses that, once implemented and tested, will either solve the identified problems or lead to further hypotheses to solve the problems.

The following chapter will present an investigation of technical order related literature. That investigation will be used as a basis for this research project.

II. Literature Review

This literature review will be concerned with two major areas. The first area to be examined will be the research aimed at the identification of technical order related problems. The second area to be examined will be the research aimed at recommending changes to the technical order acquisition process to solve the identified problems. In addition, the relationship between the problems, the recommended changes to the technical order acquisition process, and the objectives of this research project will be discussed.

The Problems

The literature concerned with technical order related problems can be divided into two major categories. Those categories are the literature aimed at user-oriented problems caused by technical orders, and the literature aimed at the problems with the technical order acquisition process.

User-Oriented Problems. Ultimately, problems with maintenance TOs become user-oriented problems. If maintenance personnel use inaccurate, incomplete, or incomprehensible TOs, job performance will suffer.

Hatteric and Price (2) found that user-oriented problems result when inadequate TOs are used to perform maintenance tasks. These user-oriented problems can surface in several different ways (2:137). 1) Maintenance personnel can

use the inadequate TOs to accomplish the task which could result in inadequate maintenance performance. 2) Maintenance personnel can disregard the TOs and use their own resources to perform the task which can result in inconsistent maintenance performance that will vary with each technician. 3) Maintenance personnel can rely on supervisory personnel to develop local policy to accomplish the task which can result in satisfactory performance, but only for the area of responsibility of the supervisor involved. No matter which approach is taken, inadequate technical orders cause problems to the user.

Andrew Chenzoff (3) identified seven characteristics that an adequate technical order must possess. Chenzoff's seven characteristics are:

1. Completeness--How to make sure that the performance aids [TOs] contain all of the information that the user needs to know.
2. Accuracy--How to make sure that the information the user obtains from the performance aids [TOs] is factually accurate.
3. Relevance--How to make sure the performance aids [TOs] contain as little information as possible that has no value to any user, while insuring all users' needs are met.
4. Retrievability--How to make sure that the user can quickly find and extract the total body of information he needs for task performance.
5. Understandability--How to make sure that the user can correctly understand and interpret the information he finds.
6. Compliance--How to make sure that the user reads and uses the information and instructions provided.

7. Economy--How to provide effective performance aids (instruments that cope with the above-cited problems) within reasonable limits of cost [3:13].

When any of these characteristics are missing from a technical order, problems can occur.

Completeness. Many problems can occur if required information is omitted from TOs. Two examples are:

Reports from the Flight Test Center at Edwards AFB indicate maintenance and operating manuals received with equipment for test and evaluation in many cases do not provide adequate instructions to accomplish required tasks [8:6].

When used by Missile Maintenance personnel, SAC Civil Engineering Manuals (CEMs) cause additional maintenance dispatches, wasted manhours, and unnecessary removal and replacement of serviceable components due to a lack of adequate instructions [8:1].

Accuracy. Many problems can occur if required information is not accurate. For instance:

In the B-52 modification Inspect and Repair As Necessary (IRAN) program at Kelly Air Force Base . . . it was discovered that the technical manuals were not adequate [accurate] in checking out the avionics subsystems. Aircraft repair and return schedules had to be slipped since maintenance could not be completed [9:5].

The B-52 navigational test equipment was aligned at Kelly AFB, Texas, with TO specified coordinates for Wichita, Kansas (home of the contractor).

Relevance. TOs must contain sufficient information to allow the maintenance personnel to successfully complete the task. A survey of 248 flightline and shop technicians assigned to maintain C-141 aircraft at Charleston Air Force Base, South Carolina, and Norton Air Force Base, California shows:

Technicians expressed a strong need for good TOs that would serve both as a training and on-the-job performance aids. Based on the opinions expressed in this and the Losse et al. (1962) survey, the observation can be made that conventional TOs do not fulfill adequately the needs of maintenance technicians and personnel.

Opinions of maintenance technicians and personnel suggested that the primary need is for step-by-step information detailing how to do a particular job. In essence, the stress should be less on theoretical and more on pragmatic job-related information. In addition, there was an expressed desire for more detailed illustrations [10:6-7].

Retrievability. The problem of having to use several different manuals for one Missile Maintenance task (8:4) is an example of a retrievability problem:

Many maintenance tasks on the Minuteman Missile require the technician to use several different manuals to be in compliance with Air Force procedures [8:4].

Even if the required information is available, the job won't get done if the maintenance personnel can't find it.

Understandability. A C-141 experimental TO project shows how understandability of a given TO format is related to the skill level of the user and that performance drops when the TO is not understood by the user.

The study (2:119) compared the number of maintenance troubles identified and the number of unnecessary spare parts replaced by personnel using three different kinds of TOs. Two of the TOs used in the study were experimental, easier-to-understand formats, while the other was the conventional TO already used for the maintenance tasks being performed. The maintenance personnel performing the tasks had a high electronics aptitude (80th percentile and above).

The maintenance personnel using the two experimental, easier-to-understand TOs performed considerably better than those using conventional TOs (2:123-124).

Understandable TOs can improve maintenance performance.

Compliance. Technical orders must be complete, accurate, relevant, retrievable, and understandable. If not, the technical order will not be appropriate for the desired task. Chenzoff (3), found that if the user can not accomplish the task using a technical order, he will not use one. Compliance with technical orders should improve if the technical order is complete, accurate, relevant, retrievable, and understandable (3). However, technical order adequacy is not the only factor affecting compliance. "Don't forget the natural tendency to skip the TO when in a hurry. Using the TO takes discipline, and more discipline - ask any maintenance officer [11]!" Acquiring adequate technical orders will not guarantee compliance; however, inadequate technical orders can cause non-compliance.

Economy. The Air Force does not have an unlimited budget. Technical orders must be made as adequate as possible within the budgets allowed for them. The number of TOs needed and the level of detail required in the format both contribute to the cost of a TO. Generally, a decision must be made as to the number and the detail required to give maintenance personnel the information they require to successfully perform their duties. When the money is not available to meet the projected TO needs, compromise

usually results. This compromise can result in problems of completeness, accuracy, relevance, retrievability, and understandability.

Remarks. Technical orders can cause problems for the user if they are not complete, accurate, relevant, retrievable, and understandable. Not only must technical orders contain all of the preceding characteristics, they must also be affordable. Technical orders are procured through a system that will be referred to as the technical order acquisition process. This technical order acquisition process is responsible for supplying the users with appropriate technical orders for their assigned tasks. Deficiencies within the technical order acquisition process can result in the acquisition of inadequate technical orders. Technical order acquisition experts are concerned that several deficiencies within the technical order acquisition process will lead to inadequate technical orders being acquired in the future.

Technical Order Acquisition Problems. Hatterick and Price (2) found that data collected over the last 20 years suggests that the performance of maintenance personnel can be improved through the acquisition of adequate technical orders (TOs) (2:133). Kirsch (4) supported this finding when he wrote:

It is evident that a great deal of research has been devoted to devising methods to improve job performance aids (TOs). It is also evident that the evolution of acquisition policy is being influenced by research findings; however, it takes a great deal of time for

revised policy to filter down through the various policy levels [4:33].

Literature on technical order acquisition process problems is virtually non-existent. A major objective of this research project is to identify those problems. Top technical order experts throughout the Air Force were interviewed either in person or by telephone. Those interviews, as well as a review of Regulations, Memorandums, and Directives, revealed four major problems with the technical order acquisition process that concern the experts. Those four problems are:

1. Technical order planning does not begin early enough in the acquisition cycle of Air Force systems.
2. Coordination and communication between all agencies involved in the weapon system acquisition process is not adequate.
3. Manpower dedicated to technical order acquisition is not adequate.
4. Training and assistance for technical order acquisition personnel is not adequate.

The experts indicated that these four problems are the major problems with the system today. They also felt that these problems are responsible for the majority of the user-oriented technical order inadequacies of the past (12).

Need for Earlier Planning. Increased interest in supportability and reliability as part of life cycle cost considerations of system acquisition programs has resulted in the need for earlier planning of TO acquisition objectives.

Initiative No. 9: System Support and Readiness of the Deputy Secretary of Defense Memorandum of the Acquisition Improvement Program (AIP) Second Year End Report states:

Applicable Directives and Instructions (5000.1, 5000.2) have been revised and 5000.39 is in revision to increase the priority of support and readiness in acquisition programs [13:12].

Recommendation 9 of the Deputy Secretary of Defense Carlucci initiatives includes a major emphasis on support issues. Improvement of readiness should be a major objective of the Administration, and implementation must take place. Improvement will require additional technical effort and resources early in acquisition programs (5:p.9-155).

The technical order acquisition process must be planned, progressively monitored, and updated to insure timely completion and delivery for adequate logistics support (14:p.29-1). Items that must be included in the process have been identified through various research and inspection projects. Those items include:

Any change to AFR 8-2, TO 00-5-1, etc. must consider the total TO production effort, not just the final verification exercise. If we do not provide the contractor with proper guidance as to user needs during TO development, we cannot expect to be completely satisfied when actual verification takes place [15].

Also, earlier attention should be given to:

The method of projecting critical maintenance manpower skill limitations and translating these into design constraints and objectives for inclusion in RFPs and specifications [5:p.9-164].

The U. S. Air Force Technical Order Management Group Executive Committee added:

Target military populations, in terms of skill level, for each TO must be determined by the using command early in the acquisition phase and made part of the validation/verification plan by the TOMA. Using commands must provide proper skill ratios during actual verification [16:5].

Early and detailed planning is required to prepare the Technical Order Management Plan. Air Force Logistics Command / Air Force Systems Command Pamphlet 800-34,

Acquisition Logistics Management, states:

Upon setting up the TO requirements, the TOMA . . . should prepare a draft TMP (Technical Order Management Plan). This draft should be submitted with the DID requiring contractor development of the TMP as part of the RFP. The draft serves as a guide for the contractor(s) to follow in developing the details to be included in the TMP [14:29-2].

Increased interest in supportability and reliability as part of life cycle cost considerations of system acquisition programs has resulted in specific regulations and directives for earlier planning of technical order acquisition objectives.

Interviews were conducted with members of the U.S. Air Force Technical Order Management Group Executive Committee (CTOM). Members of the CTOM are the top technical order managers from each Major Command in the Air Force. They do not believe that technical order personnel are being assigned to system acquisition programs early enough in the system acquisition cycle to accomplish the goals required of them by regulation (17). In fact many acquisition programs (less than major) do not even have technical order acquisition specialists assigned (17).

Implementing regulations is not easy. The Deputy Secretary of Defense Memorandum for Improving the Acquisition Process (5) states:

A difficulty with implementing recommendations regarding the acquisition process is the great number of players involved to make implementation succeed. This requires persistent, intensive, follow-up effort to make sure that the recommendations really do take hold. The most common reason for non-implementation is simply that relentless action on the part of top management is not taken to insure that recommendations are, indeed, implemented. OSD has, in the past, focussed a great amount of management attention on policy development and resolution. However, OSD has not monitored implementation of the policies on a program basis [5:p.9-171].

A change in policy and acquisition objectives takes time and work through all levels of management. Getting support and TO considerations higher priority is a needed change that has not happened yet:

There is a widespread belief that performance and schedule are DOD's principal objectives. There is a need for industry to apply more of their design talents to reducing reliability and support problems. Beyond this is a need to improve the identification and specification of maintenance manpower constraints and for industry to include these constraints in the designs [5:p.9-64].

Another Deputy Secretary of Defense Memorandum further stated:

Cost and schedule pressures continue to dominate the structure and acquisition strategy of most programs. Too little management attention and resources are devoted to structuring the early design and test sequences for achieving R&M and readiness objectives and implementing the most efficient support strategy [13:12].

This problem has also been identified in the Technical Order Lessons Learned Bulletin (8), published by the Air Force Acquisition Logistics Center:

The "bottom line" is that the magnitude of the program and the management expertise required to acquire TOs successfully is frequently not recognized until it is too late. Early planning and follow-up are essential to a successful TO program; as documented in many of the Lessons Learned [8:10].

TO Managers are not always assigned early enough to accomplish all the TO acquisition tasks assigned to the TOMA. The TO Manager for the F-15 program was assigned two days prior to final source selection review (18). The T-46A system program director stated that TO considerations for his program were basically the result of efforts by himself and the DPML prior to the assignment of the TO Manager (19).

Technical order planning does not begin early enough in the system acquisition cycle.

Better Coordination and Communication. The technical order acquisition system is not self-contained. Coordination and communication between technical order personnel and other system acquisition agencies is imperative:

. . . considerations and tradeoffs should be made, in coordination with the appropriate AFLC/ALC, by the Systems Program Office (SPO) Data (TO) Manager, or similar office [20:23].

The best plan in the world is useless if the contractor does not know what is wanted:

The contractor should develop a validation plan that states how and when TOs will be validated. The TO Manager must review this validation plan and ensure that the contractor does a thorough validation. The validation plan must become part of the Technical Order

Publications Plan [TOPP - the same as a Technical Order Management Plan] which should be a binding contractual document [8:6].

An interview with Mr John Winters from the Defense Material Specifications and Standards Office (7), identified a problem with contracts and MIL Standards. MIL Standards are the basis of our contract system. TO acquisition MIL Standards are very complex. One MIL Standard is like a tree with many branches. One MIL Standard may refer to many other MIL Standards. MIL Standards are dynamic and are continually being revised and changed. Intensive research and training is required to know the status of the MIL Standards being used to acquire TOs. With the manpower and training limitations put on the TOMA, the desired level of MIL Standard knowledge is not always achieved. Often resulting in contracts with one-time special case clauses or contracts that do not acquire the expected product. This results in renegotiating, and higher costs. Better coordination and transfer of information between Technical Order Managers and MIL Standard specialists is needed (7).

Another example of needed coordination is in the establishment of system timetables:

When an acquisition urgency exists, the impact on technical manual preparation should be determined, relative to sustaining O&M and other support areas and such facts presented to higher echelons to establish an adjusted realistic schedule. Provide for utilization of corrected preliminary manuals until final manuals are available (8:19).

If TO support timetables are not adjusted to coincide with the rest of the system, problems similar to one briefed

to the Centralized Technical Order Management Group Executive Committee could result: TOs with critical ballistics information were not available when the bombs were delivered. The Armament Division was responsible for testing the weapons and developing the ballistics data. Due to manning cutbacks, the data was not available to the TO contractor in enough time to complete the TO prior to the completion of production on the bombs (17). This is an example of how early planning and coordination are both critical to the TO acquisition process.

Air Force Systems Command Pamphlet 800-3, Acquisition Management (21), stresses coordination in the acquisition process:

Accomplishing program objectives during all phases [of the System Acquisition Process] requires team work and support from all available sources. Some of the tasks . . . are performed by personnel assigned to organizations other than the program office and some are performed before a program office is organized. Other tasks involve normal staff support vital to program resources such as financial, personnel, procurement, and so forth. After a program office is formed, the program manager is the focal point for leadership of team efforts concerning the program. No program office is completely self-sufficient. Program managers should take full advantage of skills available in staff offices and coordinate efforts of related activities [21:p.1-9].

Technical Order Managers (TOMAs) are not the only personnel involved in the technical order acquisition process. Some others identified by regulation are the Program Manager (PM) (14:p.2-1), the Deputy Program Manager for Logistics (DPML) (22:3), the Integrated Logistics Sup-

port Manager (ILSM) (23:2), and the functional divisions within the System Program Office (SPO) (21:fig.10-2).

Using and supporting commands are also involved in the TO acquisition process. AFALDR 800-2, DPML/ILSO Responsibilities and Management Indicators (24:3), states: "It is mandatory that the data requirements [TOs] be coordinated with the using and supporting commands prior to being included in contract requirements."

Although the TO manager is responsible for the acquisition of TOs, he or she should use the using commands to plan and accomplish the acquisition program. This will require setting up a point of contact at the using command, ATC, and the ALC designated as the system manager or item manager (SM/IM) to act as the organizational representative [14:p.29-1].

Air Force Logistics Command should also be involved in the coordination effort within the TO acquisition process:

AFSC is responsible for technical publications during the conceptual, [demonstration/validation], and acquisition phases of the system life cycle. During the operational phase (after PMRT), AFLC assumes responsibility for these publications [25:5].

AF Acquisition Logistics Center (AFALC), formerly AFALD, is also involved in the coordinating process. AFALD Regulation 800-2, DPML/ILSO Responsibilities and Management Indicators (24:2), directs: "AFALD staff agencies will support the DPML/ILSO in carrying out the responsibilities identified herein."

The role of the Air Force Acquisition Logistics Center (formerly AFALD) in the technical order acquisition process

was identified by the USAF Centralized Technical Order Management Executive Committee (16:6):

AFALD/PTL gives help and guidance to the DPML/IILSM and TOMAs as required, in structuring the TO program. Help to determine the type and format of TOs is included. Mr Stiegmann will contact AFALD pertaining to their role in assisting with TO formats.

The TO acquisition system is a part of the system acquisition program. A high degree of coordination and communication is required between the TO acquisition elements and other system acquisition elements.

At the November 1983 meeting of the Centralized Technical Order Management Group Executive Committee (17), the representative from the AF Logistics Management Center presented the preliminary results of a survey of TO Managers. The survey included individual interviews with 17 TOMAs, 6 supervisors, and a group interview with 24 TOMAs. The preliminary results indicated that those interviewed felt a major problem was the unresponsiveness of other acquisition and using organizations to TO acquisition problems. Those interviewed also felt that there was a lack of "clout" within the TO acquisition process. The discussion of these problems identified a lack of early TO acquisition planning, and coordination between the various system acquisition agencies as the primary causes of these problems.

The CTOM members (17) also believed that the coordination with other acquisition agencies is inadequate to properly acquire technical orders.

Manning. The AF Logistics Management Center interviews with technical order acquisition personnel indicated that those interviewed considered manning to be the number one problem facing the technical order acquisition process (17). They felt that there is no standard or criteria for assigning technical order managers to a program. In fact, many programs do not have full-time technical order managers.

Research by Williams and Winn (9) supports the observations of the technical order managers interviewed by the AF Logistics Management Center:

Overall manning of the ILS [Integrated Logistics Support] effort, including the Technical Data element, is significantly below that requested [9:10].

Inadequate manning is in itself a problem, and is also a major contributor to the other technical order acquisition problems. Earlier planning in the technical order acquisition process requires adequate manpower to accomplish the job. Better coordination and communication with other agencies also requires manpower.

Training. Mr. Wilton Stiegmann, HQ USAF/LEYE, is the chairperson of the Centralized Technical Order Management (CTOM) Executive Committee. He stated:

Corporate memory in the technical order acquisition process is very low. There is no formal career field for technical order acquisition managers. Personnel performing duties as technical order acquisition managers usually have little or no experience in the field prior to being assigned to a specific project. They learn through trial and error, then they are transferred and their knowledge goes with them [12].

A problem identified in the AF Logistics Management Center Survey of TOMAs (November 1983) was the difficulty they were having getting TO requirements into a contract (17). This problem was identified primarily as a training/education problem. There are 170 reference documents (17) needed to compile a good TO acquisition contract. These reference documents include TO acquisition regulations, TO MIL Specs, and many others. The TOMAs felt that many references were outdated, vague, and confusing. One of the tasks of the Centralized Technical Order Management Executive Committee Meeting (17) was to get AF wide coordination on several TO acquisition regulations. The problem with MIL Standards is primarily a training problem.

An interview with Mr. John Winters from the Defense Material Specifications and Standards Office (7) added one more dimension to the problem with contracts and MIL Standards. MIL Standards are dynamic and are continually being revised and changed. Intensive research and training is required to know the status of the MIL Standards being used to acquire TOs. With the manpower and training limitations put on the technical order manager the desired level of MIL Standard knowledge is not always achieved.

The Deputy Secretary of Defense Carlucci Memorandum identified the need for increased training of acquisition personnel:

USDRE should consider utilizing a number of creative techniques to translate the intent of these recommendations to all levels. This could include

formal training sessions, conferences, video taped training films, articles, and policy letters [5:p.9-172].

Formal training does exist. The Air Force Institute of Technology has a two-week training course for technical order acquisition managers. The program is only two years old and as more graduates reach the field, there should be a considerable improvement in the knowledge level of technical order acquisition managers. However, one two-week course is not enough (18). The CTOM members (17) feel that "corporate memory" is a vital key to training technical order acquisition personnel. Many technical order acquisition personnel are not able to attend the formal training, and those that do often work in technical order acquisition long before they attend the training (18). The CTOM members and the technical order managers interviewed (17) stressed the need for individual assistance from some form of "assistance agency." Mr Stiegmann (12) added that the Navy does assist their technical order managers with just such an "assistance agency" (to be discussed later). He further commented that such specialized assistance is needed in addition to increasing formal training.

Mr. Munguia (18), the course director for the Air Force Institute of Technology Technical Order Acquisition Management Course, summarized the general training problem:

The knowledge and expertise required to effectively manage a technical order acquisition program is immense. In a two week course, I can not do much more than give an overview of the major topics. The best the students can do is learn the scope of their

responsibilities and hopefully where to go to when they need assistance with the details. Unfortunately, right now there is really no place they can go to get the assistance they need. They generally turn to other technical order acquisition managers who may or may not have the correct information for them. Each program has unique needs and what was good for one may not be good for another. They need experts and specialists to turn to for assistance [18].

Remarks. There do appear to be problems with the technical order acquisition process. Technical order planning needs to begin earlier in the acquisition cycle. Better coordination and communication between all agencies involved in the weapon system acquisition process is needed. The problems will require more and better trained manpower before they can be solved. The next section will discuss changes to the technical order acquisition process that have been recommended to solve those problems.

Recommended Changes

Recommendations for improving the technical order acquisition system have come from a variety of sources. The recent concern for life cycle cost considerations and an increased interest in maintainability and reliability in the system acquisition program have resulted in new system objective priorities which require changes to the technical order acquisition process.

Recommended changes to the technical order acquisition process will be discussed as they relate to the four problem areas identified in the preceding section of this literature review. Those four problem areas are:

1. Need for earlier planning.
2. Better coordination and communication.
3. Manning.
4. Training.

The recommended changes are not mutually exclusive. The technical order acquisition process is an embedded system within the system acquisition process. As a result, there are no cut and dry dividing lines between activities within the system. In fact, there are no cut and dry dividing lines between the four problems identified above. For example, the need for earlier planning is partially a result of a lack of coordination between acquisition agencies. The lack of coordination is partially a result of the lack of training of the participants and partially the result of not having enough manpower to effect the required coordination. Some recommended changes will affect more than one problem.

Need for Earlier Planning. Technical order planning does not begin early enough in the acquisition cycle. Recommended changes to solve this problem include:

1. Establishment of a technical order management center.
2. Establishment of "skeleton" Statement Of Needs (SONs), Requests For Proposals (RFPs), and contracts.
3. Establishment of technical orders (operations and maintenance manuals) as a "product" to be included as a separate line item in the SON, RFP, and contract.

Technical Order Management Center. Interviews with technical order acquisition personnel (17) indicate a

need for a central Air Force agency (tentatively called Air Force Technical Order Center) which could assist technical order acquisition personnel with problems confronting them during technical order acquisition.

The members of the CTOM committee also recommended the establishment of an Air Force Technical Order Center (AFTOC). They have established a work group to recommend several alternative centralized technical order management organizations to the Air Staff (6:5).

The Navy uses a centralized management agency system. For aircraft acquisitions, the Naval Air Technical Service Facility (NAVAIRTECHSERVFAC) performs the centralized technical order management function. Mr. Tom Martin, from NAVAIRTECHSERVFAC, stated that his organization is heavily involved in the early conceptual phases of the acquisition process. Their specialists assist in early planning and procurement actions affecting technical orders. Some early planning responsibilities of the NAVAIRTECHSERVFAC are identified in NAVAIRINST 5600.20B (26:11):

1. Coordinate and maintain TM plans that shall provide for coverage of each complete system and its related equipment and components.
2. Prepare TM requirements for inclusion in contracts, procurement requests, AIRTASKS, project orders or work requests, as required, and place orders through proper contracting channels.
3. In consonance with policy direction from the TM program coordinator, develop procedures for effective TM project management.

The Army also uses a centralized technical order management agency. The Army system is being used as a model for the CTOM work group recommendations.

A centralized technical order management center has been recommended to provide earlier technical order planning assistance to acquisition programs.

Skeleton Documents. The recommendation for skeleton documents to assist technical order acquisition personnel was made by the Air Force Inspector General team in a briefing to the CTOM committee (17). Statement of Needs (SONs) identify operational needs to meet a threat. The SON for a project is the first step in the acquisition of a new system. The inclusion of technical order needs in a SON will facilitate earlier technical order planning. The SONs are developed before an official Systems Program Office is formed; therefore, a "skeleton" of the technical order needs that could be included in a SON could be a help to the personnel writing the SON. The Request for Proposal (RFP) is the document that gets the contractor involved in the process. A "skeleton" of the possible technical order needs could help the personnel writing the RFP make the contractor aware of those needs from the beginning. A "skeleton" of items that should be considered when writing a contract could also be useful.

"Skeleton" technical order requirements for these acquisition documents can help early planners identify tech-

nical order needs in early phases of the acquisition process.

Technical Orders as a Product. The Air Force purchases "data" which includes all the engineering drawings and blueprints used to develop the system as well as the operations and maintenance manuals.

Mr John Winters (7), from the Defense Material Specifications and Standards Office recommended that the Air Force separate manuals (TOs) from data in the acquisition process. He said that the Army and Navy purchase technical manuals as a separate line item product. He believed that as a separate line item, technical order needs would be more visible to early planners and the contractor. Including technical orders as a separate line item would force planners to focus attention on technical orders much earlier than they do now.

Mr Stiegmann (12), HQ USAF/LEYE, expressed similar thoughts on the subject.

Remarks. The recommendations for getting earlier planning for technical order acquisition includes the establishment of a centralized technical order management agency and the development of "skeleton" documents to assist early planners. The inclusion of technical orders as a separate line item product was also suggested to force earlier attention to technical orders. The three recommendations are complementary to each other and combined with better coordination and communication between acquisition agencies, as

well as improved manning and training of technical order acquisition personnel, should result in earlier planning of technical order acquisitions (12).

Better Coordination and Communication. Better coordination and communication between technical order acquisition agencies and other acquisition agencies is needed. Recommendations to solve this problem are:

1. Establishment of a technical order management center.
2. Establishment of "skeleton" Statement Of Needs (SONs), Requests For Proposals (RFPs), and contracts.
3. Establishment of a handbook identifying coordination/communication responsibilities.

Technical Order Management Center. The technical order acquisition management center recommended in the preceding section of this thesis can also help improve coordination and communication between technical order acquisition personnel and other acquisition agencies(6). As a center of specialized technical order acquisition knowledge, the technical order management center can assist acquisition personnel with technical order information. The center will be especially important to assist in the early phases of the acquisition process prior to the assignment of technical order management personnel to a program. An important responsibility assigned to the NAVAIRTECSERVFAC is to insure that proper coordination of technical order requirements is accomplished (26). A technical order management center could

perform a similar function for the Air Force to help improve coordination and communication.

Skeleton Documents. The recommendation for "skeleton" documents has been discussed in detail in a preceding section. The Statement Of Need (SON) and Request For Proposal (RFP) are generally accomplished prior to the assignment of technical order managers to the acquisition program. "Skeleton" documents can help improve coordination and communication with other acquisition agencies prior to the assignment of a technical order manager to a project. The skeleton document would be a starting point for planning, but a point of contact would also have to be established to assist individual programs with the use of the documents (18).

Handbook. The recommendation for a handbook to improve the coordination and communication between the acquisition personnel and other agencies came from Mr. Munguia (18), the course director for the technical order acquisition management course at AFIT. Feedback from his students indicates that the amount of coordination required for technical order acquisition is overwhelming. He felt they would benefit from a handbook dedicated specifically to identifying the required coordination and communication channels. Mr Stiegmann (12), HQ USAF/LEYE, added that such a handbook should be of value to the other acquisition agencies involved with technical order acquisition also. They

could see what their coordination and communication responsibilities are.

Remarks. Recommendations to improve coordination and communication include a technical order management center, "skeleton" documents, and a handbook, as well as improving manning and training of technical order personnel.

Manning. Recommendations to improve manning problems in the technical order acquisition field include:

1. Establishment of a separate AFSC for technical order managers.
2. Establishment of a technical order management center.

Separate AFSC. The CTOM committee (27:6) recommended the establishment of a separate AF Speciality Code (AFSC) for technical order managers. Without a separate AFSC, there is no continuity "pipeline" for technical order management personnel. Technical order managers are generally on the job just long enough to become proficient; then they return to their previous AFSC (12).

Technical Order Management Center. The recommendation of the technical order management center has been discussed in a previous section of this thesis. The establishment of a technical order management center will allow smaller programs to effectively purchase technical orders without the assignment of a technical order manager. The technical order management center can assist in technical order acquisition needs of those smaller programs, thus reducing the need for technical order management manpower in

those programs. The end result will be a reduction of manpower requirements over-all (18).

Remarks. The recommendations aimed at solving manning problems are complementary. The establishment of a separate AFSC for technical order managers is aimed at retention, and the technical order management center is aimed at reducing the over-all manpower requirement.

Training. Recommendations aimed at solving the training problem are:

1. Separate AFSC for technical order managers.
2. Technical order management center.
3. Handbook.

Separate AFSC. The recommendation for a separate AFSC for technical order managers has already been discussed. A separate AFSC will help retain trained technical order managers which will result in a higher average training level.

Technical Order Management Center. The recommendation for the technical order management center has already been discussed. The management center can assist technical order managers with specific problems. That assistance will increase the knowledge of the technical order managers.

Handbook. The recommendation for a handbook on coordination and communication channels between technical order acquisition personnel and other acquisition agencies has already been discussed. Such a handbook can help increase the knowledge of technical order managers.

Remarks. The recommendations to improve the training level of technical order managers are complementary. The establishment of a separate AFSC will help keep trained technical order managers. The technical order management center and the handbook will help increase the knowledge of technical order managers.

Chapter Summary

User-oriented problems of inadequate technical orders have been identified. Problems with the technical order acquisition process that could result in the acquisition of inadequate technical orders have also been identified, as well as recommended changes to the technical order acquisition process aimed at solving those problems.

The technical order acquisition process problems are:

1. Technical order planning does not begin early enough in the acquisition cycle.
2. Coordination and communication between all agencies involved in the weapon system acquisition process is not adequate.
3. Manpower dedicated to technical order acquisition is not adequate.
4. Training and assistance for technical order acquisition personnel is not adequate.

The recommended changes to the technical order acquisition process are:

1. The establishment of a technical order management center.
2. "Skeleton" Statement Of Needs (SONs), Requests For Proposals (RFPs), and contracts.

3. Treat technical orders as a "product" to be included as a separate line item in the SON, RFP, and contract.
4. Handbook identifying coordination/communication responsibilities.
5. Separate AFSC for technical order managers.

The objective of this research project is to answer four research questions that relate to the four problems identified with the technical order acquisition process.

Those four research questions are:

1. How can technical order acquisitions be integrated into earlier phases of the weapon system acquisition cycle?
2. How can communication and coordination between technical order acquisition agencies and other acquisition agencies be improved?
3. How can technical order acquisition personnel manning and retention be improved?
4. How can training and knowledge of technical order acquisition personnel be improved?

These four questions will be answered by testing the validity and completeness of the recommended changes to the technical order acquisition process that have been identified. Those recommendations that are found to be valid will in effect be hypotheses that, once implemented and tested, will either solve the problem or lead to further hypotheses to solve the problems.

III. Methodology

Justification of Research Method

It was noted in the introduction that because this research was exploratory in nature, no hypotheses were to be tested. Rather, problems with the technical order acquisition process were identified in the literature review, along with recommended solutions to those problems. The purpose of the research phase was to assess the validity and completeness of the problems and recommended solutions.

This assessment was accomplished through telephone interviews with personnel active in the TO acquisition process. The respondents were asked to express their agreement or disagreement with the problems and recommended solutions presented to them during the interview. The interview schedule is presented as Appendix A. The magnitudes of the respondents' agreement or disagreement with the identified problems and recommended solutions were used to determine the validity of those problems and solutions to accurately reflect the actual conditions of the TO acquisition process. In addition, open-ended questions were asked to determine if the identified problems and recommended solutions represented a complete list.

Structured questions were used for the interviews; however, the inherent flexibility of personal interrogation allowed for amplification of responses as necessary.

The versatility of this method is its greatest strength. It is the only practical way to learn many types of information and the most economical way in many other situations [28:213].

Although several of the personnel interviewed were located on the same installation as the researchers, telephone interviews were used in all cases. This was done to eliminate possible response errors due to one group receiving personal interviews and the other telephone interviews.

Population Description

The subject of this research was the technical order acquisition process. Four product divisions of the Air Force Systems Command (AFSC) dealt with the acquisition of major AF weapon systems and related equipment, and thus were within the scope of this research. They were the Aeronautical Systems Division (ASD), the Electronics Systems Division (ESD), the Armament Division (AD), and the Ballistic Missile Office (BMO). The fifth product division in AFSC, Space Division, was not included in the research because of the unique, non-weapon system nature of the equipment acquired by that division.

A description of the organizational structures of the four divisions is necessary to understand the nature of the population. These structures differ because of the varying scope of the programs for which the divisions are responsible. For example, ASD deals with major systems acquisitions such as aircraft, simulators, engines, and related

aeronautical equipment, while ESD and AD deal with smaller weapon systems or subsystems of larger systems. What follows is a general description of the different divisions' System Program Office (SPO) organizations, recognizing that each SPO will differ in detail.

In ASD, individual SPOs are often large organizations, with separate offices dedicated to specific acquisition responsibilities, and these separate offices contain specialists in the corresponding areas. In general, each ASD SPO has three levels of responsibility regarding TO acquisition. At the upper level are Program Managers (PMs), who are responsible for the acquisition of the entire system, including TOs. Reporting to the PM is a Deputy Program Manager for Logistics (DPML), who is responsible for the portion of system acquisition that relates to logistics, again including TOs. Finally, there are Technical Order Managers (TOMAs), reporting to the DPML, that coordinate and manage the day-to-day activities of TO acquisition.

In contrast to the large-scale SPOs typical of ASD are the SPOs of ESD and AD. The systems these divisions are responsible for acquiring are typically smaller in scope than those of ASD, with a corresponding reduction of dedicated functions within those SPOs. Neither division has TOMAs per se; in ESD the DPMLs perform TO acquisition as part of their normal duties, while in AD TO acquisition specialists are matrixed from a central office into SPOs as required. The organization of BMO is a mix of the other

three; the SPOs are large (as in ASD) but few in number, while TO acquisition personnel are matrixed from a central office similar to the ESD and AD structure.

The personnel interviewed for this research were those within the four product divisions who are involved in TO acquisition, and members of the USAF Centralized TO Management (CTOM) Group. The CTOM, comprised of TO specialists from the major commands, was described in the introduction to this report.

For each product division, respondents were grouped according to their duty category, rather than strictly by their title. A list of all the current systems active in the four product divisions was provided by the Basis Production System, a data base maintained by the Air Force Acquisition Logistics Center at Wright-Patterson AFB. This list included the names and telephone numbers of the DPML for each system, from which duplicates were eliminated, and the list was then used as a starting point for interviews.

When conducting the survey with each DPML, the interviewer requested the name and telephone number of their respective PM and TO specialist. By this technique the respondents in ESD, AD and BMO were functionally grouped into the three basic levels of responsibility seen in the TO acquisition process: overall managers, logistics managers, and TO acquisition specialists. In this manner the list of potential respondents grew from only DPMLs to include the duty categories of PM and TOMA.

The intent of the research was to conduct a census rather than a sample of personnel involved in TO acquisition. This was possible because of the relatively small size of the population. Of the original 54 DPMLs identified, 49 DPML interviews resulted, 43 of which were with the original DPMLs (or their replacements). The variation in the responses from the original DPML list came as a result of personnel transfers without replacements, and SPO reorganizations. These statistics are discussed here to point out the difficulties encountered in conducting a census.

The identification of the PM and TOMA population presented unique problems. The total number of PM and TOMA personnel is unknown, and efforts to determine those totals were complicated by the method of grouping by duty category rather than by title. Thus, the fact that seventeen PMs and fifty-three TOMAs were interviewed cannot be related to a possible total. The authors assumed that the PMs and TOMAs identified by the DPMLs were all the personnel who function in those positions.

The following is a list of the respondents in each category and division:

Division	PM	DPML	TOMA	Total
ASD	13	21	27	61
ESD	2	18	17	37
AD	1	7	7	15
BMO	1	3	2	6
Total	17	49	53	119

In addition, 11 CTOM members were interviewed. This elevated the total number of telephone interviews to 130.

The Telephone Interview

The method of interrogation was a telephone interview in all cases, with the same interview schedule used for each interview. The instrument (see Appendix A) began with an introduction by the interviewer to the respondent, explaining the purpose of the interview and giving a brief overview of the research.

The first questions were open-ended, or overhead, designed to learn of any problems or solutions to problems that the respondent believed were important. The remainder of the questions dealt with the specific problems and recommended solutions that this research was attempting to assess. The interviewer requested that responses to the later questions be either "yes" or "no"; however, the interviewer noted any additional comments.

The respondents were considered to be independent of each other. Thus no specific sequence of interviews was followed. This allowed other interviews to be conducted if a particular respondent could not be contacted for some period. No information will be presented that links an individual to a specific response.

Research Methodology

An explanation of how the results of the telephone interviews were used for this research follows. The actual

results and findings will be discussed in later chapters of this report.

The purpose of the telephone survey was to assess how accurately the previously identified TO acquisition process problems, and the recommended solutions to those problems, represented the views of those people involved in the technical order acquisition process. In order to perform this assessment the responses of the four product divisions were compared with each other, as were the responses of the individual duty categories (PM, DPML, TOMA and CTOM). Significant disagreement between the divisions or duty categories on individual questions was evaluated to determine if the cause of the discrepancy was related to the inherent differences in the groups, or caused by a previously undiscovered problem or recommended solution. The basis for this evaluation was the additional comments made by the respondents, and the authors' knowledge of the differences in the groups.

Validation of the identified problems and solutions was determined by noting whether or not a majority of the respondents agreed with the stated problems and solutions. Survey questions dealing with validation were constructed to result in either a "yes" or "no" response.

Completeness was assessed by the use of open-ended questions, to determine if any areas were overlooked in the identification of either TO acquisition problems or solutions to those problems. These open-ended questions preceded

the validation questions so that respondents would not be led to answer with specific problems and solutions already in mind. Thus, the respondents provided their own views of problems, and recommended solutions to those problems, without prior knowledge of the research questions.

Responses to the open-ended questions were evaluated to determine if they fit into the category of one of the research questions. The number of responses that supported this research was then compared to the number that did not. Those that did not were further evaluated to determine if a pattern existed that justified comment. The responses to the open-ended questions were not evaluated separately by division or duty category. It was expected with these questions that individual differences were more likely to occur than were group differences.

These are the guidelines that were used to evaluate the validity and completeness of the problems and solutions being assessed. Where differences between groups were found, they were used to help to explain the problems or to justify the solutions being tested. The differences were also of some value in determining the final recommendations of this exploratory study.

The simplicity of the evaluation guidelines used reflects the exploratory nature of this research. The data gathered represents the opinions of personnel actively involved in the TO acquisition process. The determination of agreement (or disagreement) with the identified problems and

solutions was intended to be an aid to those charged with the improvement of the TO acquisition process. This information should provide confidence that the implementation of the recommended solutions will correct, or at least ease, the current problems.

When the telephone interviews were completed, the data were compiled by division and duty category. Additional comments to the "yes" and "no" questions were grouped in a similar fashion. The data was then evaluated in the method described previously. The results of those evaluations are contained in the following chapter.

IV. Results

Chapter Organization

The data gathered during the telephone interview was examined according to the purpose of the questions. The questions which tested for completeness of the identified problems and recommended solutions (1 and 2) were examined first. Next, the questions which tested for the validity of the research questions (3 through 6) were examined. The data was viewed in two perspectives: grouped by product division, and grouped by duty category. Using the same perspectives, the questions which tested for the validity of the suggested solutions (7 through 11) was then examined. The results will be presented in either a table format with the narrative, or in an appendix.

The data from interviews with members of the CTOM were not grouped with either a particular product division or duty category. Because the duties of the CTOM members cut across the spectrum of the TO acquisition process, their responses were included with each perspective, for each group being examined.

Conclusions regarding the responses will not be addressed in this chapter. Chapter V will discuss the results of the interview, and Chapter VI will make recommendations based upon the gathered data.

Completeness of the Questions

The responses to question 1 and 2 were qualitative rather than quantitative. Therefore, the responses are presented rather than a numerical chart. Appendix B is a complete list of responses to Question 1, and Appendix C lists the same information for Question 2. Each appendix displays the responses by duty category within each product division. The responses are not direct quotes; the authors synthesized the responses into main thoughts in order to improve the readability of the responses.

Validity of the Research Questions

The responses, by product division, to Question 3 through 6 are shown in Table 4.1, while Table 4.2 contains the same information by duty category.

Note that for each category and question a "% Yes" accompanies the "Yes" and "No" responses. The percentage of positive responses for a particular entry was calculated using the total number of respondents in the category. This explains cases where the percentages are identical, while the indicated number of responses may differ. An example of this is in Table 4.1, the AD category, Questions 4 and 6.

The data given by division and by duty category in this chapter are totals for their respective groups and were used in the evaluations discussed in the following chapter.

TABLE 4.1

Questions 3 Through 6 - By Product Division

Division		Question			
		3	4	5	6
CTOM	Yes	1	0	1	0
	No	10	11	10	10
	% Yes	9.1	0	9.1	0
ASD	Yes	37	19	14	11
	No	24	42	47	46
	% Yes	60.7	31.1	23.0	18.0
ESD	Yes	25	12	11	11
	No	12	25	26	26
	% Yes	67.6	32.4	29.7	29.7
AD	Yes	7	1	5	1
	No	8	14	10	13
	% Yes	46.7	6.7	33.3	6.7
BMO	Yes	4	3	2	0
	No	2	3	4	5
	% Yes	66.7	50.0	33.3	0

TABLE 4.2

Questions 3 Through 6 - By Duty Category

Duty Category		Question			
		3	4	5	6
CTOM	Yes	1	0	1	0
	No	10	11	10	10
	% Yes	9.1	0	9.1	0
PM	Yes	12	7	9	4
	No	5	10	5	8
	% Yes	70.6	41.2	52.9	23.5
DPML	Yes	31	17	13	8
	No	18	29	36	40
	% Yes	63.3	34.7	26.5	16.3
TOMA	Yes	30	11	10	11
	No	23	42	43	42
	% Yes	56.6	20.8	18.9	20.8

A more detailed breakdown of the responses to the telephone interview is given in Appendixes D, E, and F, where the responses for questions 3 through 11 are given by duty category for each division.

TABLE 4.3

Questions 7 Through 11 - By Product Division

Division		Question				
		7	8	9	10	11
CTOM	Yes	10	10	11	9	8
	No	1	1	0	2	2
	% Yes	90.9	90.9	100	81.8	72.7
ASD	Yes	38	50	54	50	41
	No	22	11	6	11	20
	% Yes	62.3	82.0	88.5	82.0	67.2
ESD	Yes	17	29	32	28	16
	No	20	8	5	9	21
	% Yes	45.9	78.4	86.5	75.7	43.2
AD	Yes	12	12	15	12	10
	No	3	3	0	3	5
	% Yes	80.0	80.0	100	80.0	66.7
BMO	Yes	3	4	6	6	5
	No	3	2	0	0	1
	% Yes	50.0	66.7	100	100	83.3

TABLE 4.4

Questions 7 Through 11 - By Duty Category

Duty Category		Question				
		7	8	9	10	11
CTOM	Yes	10	10	11	9	8
	No	1	1	0	2	2
	% Yes	90.9	90.9	100	81.8	72.7
PM	Yes	8	14	14	13	6
	No	9	3	3	4	11
	% Yes	47.1	82.4	82.4	76.5	35.3
DPML	Yes	24	38	44	40	28
	No	25	11	4	9	21
	% Yes	49.0	77.6	91.8	81.6	57.1
TOMA	Yes	38	43	46	43	38
	No	15	10	4	10	15
	% Yes	71.7	81.1	90.6	81.1	71.7

Validity of the Suggested Solutions

Questions 7 through 11 test the validity of the identified suggested solutions to improve the TO acquisition process. The responses to those questions are given in Table 4.3 and 4.4, by division and by duty category, respectively.

Summary

The results of the telephone interview were presented according to the purpose of the questions. No evaluation or explanation of the data was accomplished, other than that required to describe how the data were tabulated. The conclusions of this research, based on the data gathered in the telephone interview, will be presented in the following chapters.

V. Conclusions

The objective of this research was to identify problems with the acquisition of U. S. Air Force technical orders, and to identify possible changes to the technical order acquisition process that will solve those problems. That objective was accomplished by researching four questions.

The results of that research will be used to answer the research questions and to formulate other conclusions about the problems of the technical order acquisition process.

Answers to Research Questions

The telephone survey that was accomplished as part of this research resulted in information that could be used to answer the four research questions presented earlier. Those research questions are:

1. How can technical order acquisitions be integrated into earlier phases of the weapon system acquisition cycle?
2. How can communication and coordination between technical order acquisition agencies and other acquisition agencies be improved?
3. How can manning and retention of technical order acquisition personnel be improved?
4. How can training and knowledge of technical order acquisition personnel be improved?

Each of these questions was investigated from three perspectives. The first perspective was an assessment of the validity of the problem associated with each research ques-

tion. This assessment was accomplished by analyzing the responses to questions 3 through 6 of the telephone survey. The second perspective was an assessment of the validity of the changes to the technical order acquisition process that have been recommended as solutions to those problems. This assessment was accomplished by analyzing the responses to questions 7 through 11 of the telephone survey. The third perspective was an assessment of a relative priority for each problem and recommended solution. This assessment was accomplished by analyzing the responses to questions 1 and 2 of the telephone survey.

Each research question will be answered from all three perspectives.

Research Question Number 1. The first research question was:

1. How can technical order acquisitions be integrated into earlier phases of the weapon system acquisition cycle?

Validity of the Problem. The validity of the problem associated with this research question was tested by question 3 of the telephone survey (see Appendix A). Out of the 130 individuals interviewed, 57% believed that technical order acquisition planning began early enough to be successful. When the responses of the CTOM members were removed from the data, and only the responses of the four divisions who actively worked in the technical order acquisition process were examined, 61% of those respondents believed

that planning began early enough. Based on these results of the survey, it could be concluded that technical order planning generally began early enough in the acquisition cycle to satisfy a majority of the individuals responsible for the accomplishment of technical order acquisition. This indicates that the problem associated with research question number 1 was not considered a valid problem by a majority the respondents.

Validity of Recommended Solutions. The solutions recommended to affect earlier planning for technical order acquisition included:

1. Technical Order Management Center (Question 7).
2. Skeleton Documents (Question 8).
3. Technical Orders As A Product (Question 9)

Since the majority of the respondents did not believe that earlier planning for technical order acquisition was required, there is no need for these solutions. However, each of these solutions was also associated with other problems and will be discussed in detail later.

Relative Priority of the Problem. The relative priority of the problems associated with each research question were determined using the responses to question number 1 (Appendix A) from the telephone survey. Since question number 1 was an open-ended question, the authors had to evaluate the responses and categorize them in order to assess the relative priority of the problems. Some of the re-

sponses identified problems that fit into more than one research category. For example, a response that identified validation/verification as the most important problem with the technical order acquisition process was categorized as a training problem, a coordination and communication problem, and a manning problem. This was done because the problem of validation/verification was identified as being caused by those three problems in the literature review of this report. As a result of this multiple categorization, the percentages presented as the relative priorities of the four research questions will not total 100%. The percentages that will be presented should be useful in determining relative importance of each problem associated with the research questions.

For the first research question, 8 out of 130 (6%) indicated that the need for earlier planning was the most critical problem with the technical order acquisition process. This low percentage supports the conclusion made earlier that this was not a major problem of the technical order acquisition process.

Relative Priority of Recommended Solutions. Since the problem associated with this research question was not found to be a major problem of the technical order acquisition process, the relative priority of the solutions recommended to solve that problem will not be discussed

here. They will be discussed in conjunction with other research questions when applicable.

Remarks. The large difference of opinion between the CTOM members and the other groups must be discussed. The CTOM members responded 10 to 1 (91%) that earlier planning was needed. Only 39% of the respondents who worked directly within the technical order acquisition process believed this was a problem. This large difference in opinion may indicate a coordination/communication problem between the SPOs and the policy makers.

In addition, the solution recommending the purchase of technical orders as a product rather than as part of data was not associated with any of the other research questions, but was highly supported by the respondents (91%). This recommended solution will be discussed in detail later in this chapter and further discussion will be made in the next chapter.

Research Question Number 2. The second research question was:

2. How can communication and coordination between technical order acquisition agencies and other agencies be improved?

Validity of the Problem. The validity of the problem associated with this research question was tested by question 4 of the telephone survey. Out of the 130 individuals interviewed, 73% believed that coordination and com-

munication between technical order acquisition agencies and other acquisition agencies was a valid problem.

Based on this result of the survey, it appeared that coordination and communication was a problem.

Validity of Recommended Solutions. The solutions recommended to solve the communication and coordination problem included:

1. Establishment of a technical order acquisition management center.
2. Establishment of skeleton Statement Of Needs (SONs), Requests For Proposals (RFPs), and contracts.
3. Establishment of a handbook identifying coordination/communication responsibilities.

The validity of these recommended solutions was tested by questions 7, 8, and 10 respectively.

Technical Order Management Center. The recommendation for the establishment of a technical order management center was tested by question number 7 (see Appendix A) of the telephone survey. Out of the 130 respondents, 62% believed that a centralized technical order management center would improve the technical order acquisition process. Based on this percentage, it appeared that the establishment of a centralized technical order acquisition management center was a valid recommendation to improve the technical order acquisition process.

Skeleton Documents. The recommendation for the establishment of skeleton documents was tested by question number 8 (see Appendix A) of the telephone survey. Out

of the 130 respondents, 81% believed that skeleton documents would improve the technical order acquisition process. Based on this percentage, it appeared that the establishment of skeleton documents was a valid recommendation to improve the technical order acquisition process.

Handbook. The recommendation for the establishment of a handbook to help identify coordination and communication responsibilities between technical order acquisition agencies and other system acquisition agencies was tested by question number 10 (see Appendix A) of the telephone survey. Out of the 130 respondents, 81% believed that a handbook on coordination/communication responsibilities would improve the technical order acquisition process. Based on this percentage, it appeared that the establishment of such a handbook was a valid recommendation to improve the technical order acquisition process.

Relative Priority of the Problem. The responses to question number 1 were used to determine the relative priority of this problem. Based on those responses (see Appendix B), 93 out of 130 (72%) either directly or indirectly identified coordination/communication as the most significant problem with the technical order acquisition process. This result indicated that the respondents believed this to be a major problem of the technical order acquisition process.

Relative Priority of Recommended Solutions. The responses to question 2 (see Appendix A and Appendix C) were used to determine the relative priorities of the solutions recommended to solve this problem.

Centralized Management Center. An examination of the responses to question number 2 (see Appendix C) resulted in the identification of 57 out of 130 (44%) that either directly or indirectly identified the establishment of a centralized technical order management center as the most significant change that could be made to the technical order acquisition process.

Skeleton Documents. An examination of the responses to question number 2 (see Appendix C) resulted in the identification of 24 out of 130 (18%) that either directly or indirectly identified the establishment of skeleton documents as the most significant change that could be made to technical order acquisition process.

Handbook. An examination of the responses to question number 2 (see Appendix C) resulted in the identification of 13 out of 130 (10%) that either directly or indirectly identified the establishment of a handbook identifying coordination/communication responsibilities as the most significant change that could be made to the technical order acquisition process.

Remarks. A majority of the respondents indicated that the coordination and communication between technical

order acquisition agencies and other agencies needed to be improved. The respondents supported each of the three solutions recommended to improve that coordination and communication. In addition, the respondents identified the establishment of a centralized technical order management center as having the highest priority of the three recommended solutions.

Research Question Number 3. The third research question was:

3. How can manning and retention of technical order acquisition personnel be improved?

Validity of the Problem. The validity of the problem associated with this research question was tested by question 5 (see Appendix A) of the telephone survey. Out of the 130 individuals interviewed, 74% believed that the manpower dedicated to technical order acquisition was not adequate.

Based on this result of the survey, it appeared that manning was a valid problem.

Validity of Recommended Solutions. The solutions recommended to solve the manning and retention problem included:

1. Establishment of a separate AFSC for technical order acquisition managers.
2. Establishment of a technical order acquisition management center.

The validity of these recommended solutions was tested by questions 11 and 7 respectively.

Separate AFSC. The recommendation for a separate AFSC for technical order acquisition managers was tested by question number 11 (see Appendix A) of the telephone survey. Out of the 130 respondents, 62% believed that some form of career field or AFSC would improve the technical order acquisition process. Based on this percentage, it appeared that the establishment of some form of career field for technical order acquisition managers was a valid recommendation to improve the technical order acquisition process.

Technical Order Management Center. The recommendation for the establishment of a technical order management center was tested by question number 7 (see Appendix A) of the telephone survey. Out of the 130 respondents, 62% believed that a centralized technical order management center would improve the technical order acquisition process. Based on this percentage, it appeared that the establishment of a centralized technical order acquisition management center was a valid recommendation to improve the technical order acquisition process.

Relative Priority of the Problem. The responses to question number 1 were used to determine the relative priority of this problem. Based on those responses (see Appendix B), 17 out of 130 (13%) either directly or indirectly identified manning as the most significant problem with the technical order acquisition process.

Relative Priority of Recommended Solutions. The responses to question 2 (see Appendix A and Appendix C) were used to determine the relative priorities of the solutions recommended to solve this problem.

Separate AFSC. An examination of the responses to question number 2 (see Appendix C) resulted in the identification of 9 out of 130 (7%) that either directly or indirectly identified the establishment of a separate career field or AFSC for technical order acquisition managers as the most significant change that could be made to the technical order acquisition process.

Centralized Management Center. An examination of the responses to question number 2 (see Appendix C) resulted in the identification of 57 out of 130 (44%) that either directly or indirectly identified the establishment of a centralized technical order management center as the most significant change that could be made to the technical order acquisition process.

Remarks. It must be noted that the term "separate AFSC" is used to describe a separate "career field," which is a much broader topic than generally associated with the term "separate AFSC". The two terms are used interchangeably to indicate a method of providing a way to allow career progression and promotion within the technical order acquisition management field. The lack of potential for career progression within the technical order acquisition field

could be responsible for the high number of inexperienced personnel working in the field. It appeared that a modification to the structure of the career field that would allow for career progression was much preferred over establishing a separate AFSC for a career field with no career progression potential. This problem will be discussed further in the next chapter.

Research Question Number 4. The fourth research question was:

4. How can training and knowledge of technical order acquisition personnel be improved?

Validity of the Problem. The validity of the problem associated with this research question was tested by question 6 (see Appendix A) of the telephone survey. Out of the 130 individuals interviewed, 82% believed that the training and knowledge level of technical order acquisition personnel was not adequate.

Based on this result of the survey, it appeared that training was a valid problem. In fact, the percentage of the respondents that believed training was a problem was the highest percentage associated with any of the problems investigated in this research.

Validity of Recommended Solutions. The solutions recommended to solve the training problem included:

1. Establishment of a separate AFSC or career field for technical order acquisition personnel.
2. Establishment of a centralized technical order acquisition management center.

3. Establishment of a handbook on coordination and communication responsibilities.

The validity of these recommended solutions was tested by questions 11, 7, and 10 respectively.

Separate AFSC. The recommendation for a separate AFSC for technical order acquisition managers was tested by question number 11 (see Appendix A) of the telephone survey. Out of the 130 respondents, 62% believed that some form of career field or AFSC would improve the technical order acquisition process. Based on this percentage, it appeared that the establishment of some form of career field for technical order acquisition managers was a valid recommendation to improve the technical order acquisition process.

Technical Order Management Center. The recommendation for the establishment of a technical order management center was tested by question number 7 (see Appendix A) of the telephone survey. Out of the 130 respondents, 62% believed that a centralized technical order management center would improve the technical order acquisition process. Based on this percentage, it appeared that the establishment of a centralized technical order acquisition management center was a valid recommendation to improve the technical order acquisition process.

Handbook. The recommendation for the establishment of a handbook to help identify coordination and

communication responsibilities between technical order acquisition agencies and other system acquisition agencies was tested by question number 10 (see Appendix A) of the telephone survey. Out of the 130 respondents, 81% believed that a handbook on coordination/communication responsibilities would improve the technical order acquisition process. Based on this percentage, it appeared that the establishment of such a handbook was a valid recommendation to improve the technical order acquisition process.

Relative Priority of the Problem. The responses to question number 1 were used to determine the relative priority of this problem. Based on those responses (see Appendix B), 104 out of 130 (80%) either directly or indirectly identified training as the most significant problem with the technical order acquisition process. In fact, the percentage of respondents (80%) that believed training was the most significant problem with the technical order acquisition process was higher than the percentages associated with any of the other problems investigated in this research.

Relative Priority of Recommended Solutions. Although the solutions recommended to solve the training problem have already been discussed in conjunction with other problems, they will be restated below.

Centralized Management Center. Out of the 130 respondents, 44% identified the establishment of a cen-

tralized technical order management center as the most significant change that could be made to the technical order acquisition process.

Handbook. Out of the 130 respondents, 10% identified the establishment of a handbook on coordination and communication responsibilities as the most significant change that could be made to the technical order acquisition process.

Separate AFSC. Only 7% of the respondents identified the establishment of a separate career field or AFSC for technical order acquisition managers as the most significant change that could be made to the technical order acquisition process.

Remarks. Training appeared to be the largest single problem with the technical order acquisition process. In fact, it was very difficult to separate training problems from manning problems or any of the other problems investigated. Training referred to much more than formal education. It also included experience and "corporate knowledge."

Other Conclusions

In the process of this research, new and unexpected information was discovered. Some of that unexpected information may be relevant to future research. Among those items that may be relevant to future research was the recommendation for the establishment of technical orders as a sep-

arate product. In addition, the specific responses to question number 1 (see Appendix B) and question number 2 (see Appendix C) presented some information that might be relevant to future research. Finally, the problem of designing one technical order acquisition management process that will function effectively within the different organizational structures of the four system acquisition divisions investigated in this research may be relevant to future research.

Technical Orders as a Product. The recommendation for the establishment of technical orders as a separate product in contracts was associated with the need for earlier technical order acquisition planning. Since the majority of the respondents believed that earlier technical order acquisition planning was not needed, this recommended solution was not discussed earlier. However, 91% of the respondents believed that this recommended solution could improve the technical order acquisition process. Because such a high percentage of the respondents supported this recommended solution, it will be discussed here. Question 9 (see Appendix A) of the telephone survey was used to measure the percentage of the respondents who supported this recommended solution.

Relative Priority of the Solution. An examination of the responses to question number 2 (see Appendix C) resulted in the identification of 15 out of 130 (12%) that

either directly or indirectly identified the establishment of technical orders as a separate product as the most significant change that could be made to the technical order acquisition process.

Remarks. This recommended solution had the highest support (91%) of the solutions examined in this research. It was a valid solution and will be included in the final recommendations of this research.

It must be noted that the Army and Navy do purchase technical orders as a separate product, and the Air Force has done so on a very limited basis.

Responses to Question 1. Question number 1 (see Appendix A and Appendix B) was unstructured and was designed to find any problems that may have been omitted in this research. Out of the 130 responses, only 10 (8%) did not fit into one or more of the problem areas investigated in this research. It appeared that the problems investigated in this research were the major problems of the technical order acquisition process.

As was mentioned earlier, some responses to this question were categorized into one or more of the problems investigated in this research. Several responses appeared frequently enough to warrant individual attention here.

Those responses are:

1. Validation/verification.
2. Obtaining technical orders at the same time that the equipment is delivered.

3. Relative priority of technical orders in the system acquisition process.

Validation/Verification. As was mentioned earlier, problems with validation and verification were considered to be problems of coordination/communication, manning, and training for the purpose of this research. However, 8 of the 130 (6%) respondents identified validation or verification as the most significant problem with the technical order acquisition process. This percentage was significant enough to suggest that solutions aimed at improving coordination and communication, manning, and training should specifically address validation/verification problems.

Obtaining Technical Orders on Time. The problem of obtaining technical orders at the same time that the equipment is delivered was considered a coordination and communication, and a training problem for the purpose of this research. However, 12 of the 130 (9%) respondents identified this as the most significant problem with the technical order acquisition process. This percentage was significant enough to suggest that solutions aimed at improving coordination/communication and training should specifically address the problem of obtaining technical orders at the same time that the equipment is delivered.

Priority of Technical Order Acquisition. The problem of the relatively low priority of technical order acquisition in the system acquisition process was considered

a coordination/communication and training problem for the purpose of this research. However, 18 out of 130 (14%) respondents identified the relatively low priority of technical order acquisition needs within the system acquisition process as the most significant problem of the technical order acquisition process. This percentage was significant enough to suggest that solutions aimed at improving coordination/communication and training specifically address the problem of the priority of technical order acquisition in the system acquisition process.

Establishing technical orders as a separate product might help to raise the priority of technical orders in the system acquisition process since technical orders will become a contractual responsibility.

Responses to Question 2. Question number 2 (see Appendix A and Appendix C) was an unstructured question designed to identify any solutions that may have been omitted in this research. Of the 130 responses to this question, only 21 (16%) did not fit into one or more of the recommended solutions identified in this research. Of this 21, over half (11) pertained to automating technical orders. The remaining 10 responses were isolated and not related.

The topic of automated technical orders is in itself worthy of a research project. For the purpose of this research, automated technical orders were considered as a format for technical orders and were considered to be out-

side of the scope of this investigation into the problems of the technical order acquisition process. It must be noted, however, that it is very likely that the technical order acquisition process will have to acquire automated technical orders in the future, and any changes to the technical order acquisition process recommended in this research will have to accommodate that possibility. This topic will be discussed in more detail in the next chapter.

Problems Resulting from Organizational Differences. As was mentioned earlier, the four Divisions that were investigated differed in their organizational structure and in their technical order acquisition processes. This diversity had to be considered when investigating the problems of the technical order acquisition process. Whatever solutions are recommended as a result of this research must be effective in all of the divisions, not just one.

Since the majority of the divisions (BMO, ESD, and AD) are matrix type organizations, and generally do not have technical order acquisition personnel assigned on a one-for-one basis to a system, the technical order acquisition process must be able to accommodate this type of organization.

The recommendations that will be presented in the following chapter will attempt to accommodate the matrix organization as well as the organization with technical order acquisition personnel assigned on a one-for-one basis with a system.

Chapter Summary

The intent of this research was to validate four research questions and the solutions recommended to solve those problems. Three of the four research questions were found to be valid. The need for technical order acquisition considerations to begin earlier in the system acquisition process was not found to be valid. All recommended solutions were found to be valid.

Problems. The responses to the problems associated with the research questions were as follows:

1. Are training and knowledge of technical order acquisition personnel adequate? (82% said no).
2. Is manpower dedicated to technical order acquisition adequate? (74% said no).
3. Are coordination and communication between technical order acquisition agencies and other agencies adequate? (73% said no).
4. Does planning for technical order acquisition begin early enough? (43% said no).

The relative priorities of these problems were also discussed. The training problem was given the highest (80%) priority, while the coordination/communication problem was given the second highest (72%) priority.

Recommended Solutions. Responses to recommended solutions were as follows:

1. Do technical orders need to be treated as a separate line item product? (91% said yes).
2. Is a handbook identifying coordination/communication responsibilities needed? (81% said yes).

3. Are skeleton documents needed? (81% said yes).
4. Is a centralized technical order management center needed? (62% said yes).
5. Is a technical order acquisition management AFSC or career field needed? (62% said yes).

Relative priorities for the recommended solutions were also given. The need for a centralized technical order management agency was given the highest (44%) priority.

Final Conclusions. This research identified three major problems with the technical order acquisition process and identified five valid solutions to solve those problems. This information should give decision makers a starting point in their efforts to improve the technical order acquisition process. The next step is to determine the best way to implement these recommended solutions. This will require further investigation; however, some recommendations will be made in the following chapter.

VI. Recommendations

The objective of this research was to identify problems with the acquisition of U.S. Air Force technical orders, and identify possible changes to the technical order acquisition process that would solve those problems. That objective has been accomplished.

The five recommended solutions investigated in this research were found to be valid and should be implemented into the technical order acquisition process.

The following recommendations are offered as a starting point for the further research that will be required to develop an integrated plan for implementing those recommended solutions. Recommendations for research into new areas discovered during the course of this research will also be presented.

Integrated Implementation Plan

The results obtained in this research were based on the technical order acquisition process as it existed at the time this report was written. Once any of the solutions identified in this research are implemented, the technical order acquisition process will be changed. As a result, the implementation of one recommended solution may affect the need for another recommended solution.

In order to insure that the most effective plan is recommended, the importance of each recommended solution must be determined. The importance of the five solutions

recommended in this research was determined by the relative priority of each solution described in the preceding chapter. Those relative priorities were as follows:

1. Establishment of a technical order acquisition management center (44%).
2. Establishment of skeleton documents (18%).
3. Establishment of technical orders as a separate product (12%).
4. Establishment of a handbook identifying coordination/communications requirements (10%).
5. Establishment of a separate AFSC/career field for technical order managers (7%).

The percentages listed above represent the respondents who indicated that the associated solution was the single most important change that could be made to the technical order acquisition process.

The implementation of the above solutions will be discussed in relation to the four problems investigated in this research. The importance of the four problems was determined by the relative priority of each problem described in the preceding chapter. Those relative priorities were as follows:

1. Need for better training (80%).
2. Need for better coordination/communication (72%).
3. Need for better manning for technical order acquisition (13%).
4. Need for earlier planning for technical order acquisition (6%).

The percentages listed above represent the respondents who indicated that the associated problem was the single

most significant problem with the technical order acquisition process. The percentages add up to more than 100% because of the open-ended nature of the question used to determine the percentages and the assignment of some responses into more than one problem area.

The need for earlier planning will be discussed in these recommendations even though the majority of the respondents indicated that it was not a problem. It will be included for two reasons:

1. The solutions associated with this problem were also associated with other problems that were found to be significant. The implementation of those solutions in conjunction with those other problems will make it possible for earlier planning of technical order acquisition with little or no additional cost.
2. Even though a majority of the respondents did not consider this a problem, 43% did indicate that it was a problem.

As a result, it seems reasonable to include this problem in the following recommendations.

Centralized Management Center. The recommendation to establish a centralized technical order acquisition management center attained the highest relative priority rating (44%) of the five recommended solutions. This recommended solution was also associated with all four problems identified in this research. As a result, this recommended solution will form the nucleus of the integrated implementation plan that will be recommended.

Since this research began, the Air Force has taken steps to establish a centralized technical order management

agency. Initial plans call for an Air Force Technical Order Center (AFTOC) to be established at the Air Force Acquisition Logistics Center (AFALC) at Wright-Patterson AFB, Ohio. The final plan for the AFTOC is expected in 1985.

The following recommendations should be implemented through a gradual evolutionary process and not as a rapid change to the system. The framework should be established and then be allowed to grow only after needs and procedures have been validated on a small scale.

In order to maximize the impact of the Air Force Technical Order Center on the four problems identified in this research, three divisions of responsibility should be established. Those three divisions should be field assistance, technical specialization, and plans and programs. The term "division" will be used in this discussion to identify that portion of the AFTOC that would be assigned each of the three divisions of responsibility mentioned above. The size of those "divisions" and their actual titles should be determined as part of the final implementation plan for the AFTOC.

The field assistance division would have the most direct impact on the four problems identified in this research; however, without the assistance of the other two divisions, the field assistance division would not function effectively.

Field Assistance Division. The field assistance division should consist of experienced technical order

acquisition personnel who should be assigned the responsibility of monitoring specific programs. Individuals from this division should be familiar with the progress of their assigned programs and serve as the centralized point of contact for any technical order related advice required by the System Program Office.

This division could have an impact on all four of the problems identified in this research.

Training. The field assistance division could have a significant impact on the training problem. By monitoring the technical order acquisition progress of specific programs and being an advisor for those programs, this division could introduce additional expertise and knowledge into the technical order acquisition process. This additional expertise and knowledge would be available to all SPOs irregardless of their organizational structure. The field assistance personnel of the AFTOC would be able to assist PMs, DPMLs, or TOMAs equally as effectively.

When the field assistance division is first established, personnel should be assigned to monitor the programs that have the least experienced technical order acquisition personnel assigned to them. This would probably include programs with small ILS staffs due to the nature of the organization or the stage of development of the program. This division should gradually expand to cover as many programs as can effectively be handled. In addition, this

division should be to be available to assist any program with specific problems.

It must be pointed out that the personnel of this division should not be alone in their responsibilities. They should use the resources of the other AFTOC divisions in the accomplishment of their duties. The resources of the technical specialist division will be extremely important to the success of this division.

Coordination/Communication. The field assistance division should certainly have an impact on the coordination/communication problem. The primary responsibility of this division would be to assist the SPOs. One major objective of that assistance should be to insure that proper coordination and communication is accomplished in the technical order acquisition process for each program.

Manning. This division should also have an impact on the manning problem. Since the personnel of this division can assist SPO personnel with technical order acquisition problems, it is possible that the need for additional technical order acquisition personnel in the SPOs will be reduced. The establishment of the AFTOC will require an addition of personnel to the staff level of the technical order acquisition process. It is possible that the need to increase personnel for this function might have a higher priority than the need to increase personnel for technical order acquisition on specific programs. As a result, it appears that additional personnel might be obtained for this

staff function. The net result should be an overall increase in manpower for the technical order acquisition process.

Earlier Planning. The field assistance division should make it possible for technical order acquisition planning to begin earlier on some programs. If field assistance personnel would be assigned to monitor a program as soon as the program is established, then technical order relevant data could be compiled from the beginning of the program. Even though there are not many technical order acquisition related activities during the early stages of a program, the field assistance division would be available and familiar with the program if their assistance is needed.

The Navy performs a similar function at its Naval Air Technical Service Facility. The Navy system might be a useful reference for the implementation of this division of the AFTOC.

Technical Specialization Division. The technical specialization division should consist of personnel who are experts on specific technical aspects of technical order acquisition. Technical specialists should be responsible for the management of Air Force technical order specifications and they should participate in the DOD Technical Manual Specifications and Standards (TMSS) program. Technical specialists should also be responsible for evaluating and tracking technical order cost data. These are a few possible areas of specialization that could be included in this division. Further research is required to identify the

specific areas of specialization that should be included in this division.

The personnel of this division should serve a dual function. They should assist the field assistance division with the technical aspects of technical order acquisition. They should also assist the plans and programs division in making recommendations for improvements to technical areas of the technical order acquisition process.

The technical specialization division should impact the four problems identified in this research through the assistance that it gives to the other two divisions of the AFTOC. The technical specialists should add "corporate knowledge" to the technical order acquisition system. That "corporate knowledge" should reach the SPOs through the field assistance personnel and should influence Air Force policy through the plans and program personnel of the AFTOC.

Plans and Programs Division. The plans and programs division should have three major responsibilities. This division should have an input into policy changes and additions that affect technical order acquisition. It should continually evaluate the technical order acquisition process and identify problems and weaknesses. It should also search for new ideas and technology that might improve technical order acquisition.

Inputs to Policy. The plans and programs division should have personnel assigned to attend meetings and be on committies that are concerned with technical order

acquisition related policy. This includes working with other services on Joint Service plans and programs for technical order acquisition.

Inputs from the field assistance and technical specialization divisions should enable personnel of this division to make accurate inputs to technical order acquisition policy at all levels. The CTOM Executive Committee investigated in this report is an example of the type of committee that plans and programs division personnel should be involved with. Further research is required to identify the specific policy making organizations that could benefit from inputs of the plans and programs division of the AFTOC.

Monitor Process. The plans and programs division of the AFTOC should have personnel assigned to monitor the technical order acquisition process and to investigate any potential problems as they are discovered. This responsibility will require a close relationship with the field assistance division and the technical specialization division since those divisions should be the first to discover any problems.

Once possible problems are identified, the plans and programs personnel should investigate them and recommend solutions when applicable. They should also recommend implementation plans for recommended solutions when required. Implementation of a recommended solution may require only a minor change to the system, or it may require a policy change. In the case of a minor change, this division

should be able to effect the change through the proper channels. In the case of a major change that requires a policy change, the proper information should be given to the personnel within the division who are responsible for making technical order policy recommendations.

Even though many problems will probably be identified through the resources within the AFTOC, other organizations are involved with technical order acquisition and should not be overlooked. A formal plan should be established to effect a liaison with major contractors and each major command to get their inputs to technical order acquisition related problems.

New Ideas and Technology. The plans and programs division of the AFTOC should also have personnel assigned to examine new ideas and technology that might improve the technical order acquisition process. Computerization and automation could significantly affect technical orders and the acquisition process in the future. Plans and programs personnel from the AFTOC should be involved in the development of any new technology or system acquisition procedures that relate to technical order acquisition. They should also develop plans to ensure that the technical order acquisition process will function effectively once those new technologies or changes to the system acquisition process are adopted.

Additional Comments on AFTOC. The establishment of the Air Force Technical Order Center (AFTOC) gives the

Air Force the opportunity to make improvements to the technical order acquisition process that could help solve or reduce the impact of all four problems identified in this research. A thoroughly researched and well integrated implementation plan will be required in order to realize the full potential of that opportunity. The establishment of the AFTOC will be a major change to the technical order acquisition process and will require changes to many regulations and procedures.

The changes to regulations and procedures that will result from the establishment of the AFTOC will effect many AFSC and AFLC organizations that are involved in the technical order acquisition process. Those organizations should be involved in the planning process for those changes. The result of that planning should be an AFTOC that will provide expertise and assistance to the SPOs and technical order policy makers from a centralized location. The control of policy making and technical order acquisition should remain the responsibility of AFSC and AFLC.

The recommendations presented above identify some responsibilities that should be investigated in conjunction with the implementation plan for the AFTOC. They are based on the results of this research; however, this research is very limited in scope. As a result, these recommendations only address AFTOC responsibilities for technical order acquisition accomplished through a System Program Office.

Further research is required to determine AFTOC responsibilities for other technical order acquisitions.

Skeleton Documents. The recommendation for the establishment of skeleton documents obtained a relative priority rating of 18%. This recommended solution was associated with the coordination/communication problem and the need for earlier technical order acquisition planning.

The implementation plan for this recommendation will be effected by the implementation plan selected for the AFTOC. The purpose of skeleton documents would be to assist SPO personnel with technical order related documentation. If the AFTOC is organized as outlined in the preceding recommendation, skeleton documents may not be needed. AFTOC personnel might be able to provide better assistance to the SPOs than could be provided by skeleton documents. Further research is definitely required before any implementation of skeleton documents should be attempted.

It is possible that skeleton documents may be found useful even if the AFTOC does perform the assistance function recommended earlier. Skeleton documents could still be of use to AFTOC personnel and SPO personnel as a form of checklist.

Further research into the implementation plan for this recommendation should include an evaluation of the skeleton documents available through the ESD Computer Generated Acquisition Documents System (CGADS). Information on the CGADS can be obtained from ESD/OCHE at Hanscom AFB.

The need for skeleton documents and the specific documents that should be skeletonized should be determined only after the exact structure of the AFTOC has been determined. The final determination of the need for skeleton documents and the plan for the implementation of those documents should be a project of the plans and programs division of the AFTOC. Inputs from the field assistance and technical specialization divisions should be used to build the plan. The skeleton documents (if required) should be built by the technical specialists and their use introduced to the SPOs by the field assistance personnel. The plans and programs division should insure that any changes to policy or procedures that may be required by the introduction of skeleton documents to the technical order acquisition process are referred to the proper policy makers.

Technical Orders as a Separate Product. The recommendation for the establishment of technical orders as a separate line item product obtained a relative priority of 12%. This recommended solution was supported by 91% of the respondents.

Part of the coordination and communication problem might have been a result of the low priority assigned to technical order acquisition by contractors and SPO personnel. Making technical orders a separate contractual obligation might help raise the level of priority assigned to technical order acquisition items.

The implementation plan for this recommended solution should be developed by the AFTOC. The plans and programs division should develop the plan through coordination with the technical specialists and field assistance personnel. The plan should be approved and made policy through the appropriate channels.

The implementation of this plan will require changes to technical order related specifications and other documents. The technical specialization division of the AFTOC should be involved in making those changes.

Handbook. The recommendation for the development of a handbook outlining coordination and communication responsibilities obtained a relative priority of 10%. This recommended solution was associated with the coordination and communication problem and the training problem.

The implementation plan for this recommendation will also be effected by the implementation plan selected for the AFTOC. The AFTOC could have a significant impact on the coordination and communication problem as well as the training problem. The plans and programs division of the AFTOC should investigate this recommended solution. That investigation will require inputs from the field assistance division and the technical specialization division of the AFTOC as well as other technical order acquisition organizations. If it is determined that a handbook is still necessary after the establishment of the AFTOC, the plans

and programs division should be responsible for the development of the handbook.

Separate AFSC. The recommendation for a separate AFSC or career field for technical order acquisition personnel obtained the lowest relative priority of the five recommended solutions. This recommended solution was associated with the manning and training problems identified in this research.

The implementation plan for this recommended solution will be affected by the implementation plan selected for the AFTOC. The AFTOC could provide new opportunities for career advancement within the technical order acquisition field. So, in effect, the establishment of the AFTOC could result in a viable career field for technical order acquisition personnel.

As indicated by the small number of technical order acquisition specialists interviewed in this research, there were not enough technical order acquisition specialists to justify a separate AFSC. However, the career progression opportunities that could be made possible by the AFTOC could in effect implement the career field aspect of this recommended solution.

Final Comments on Implementation Plan. The establishment of the AFTOC is the key to the integrated implementation plan recommended above. The implementation plans or the other recommended solutions will be affected by the final implementation plan selected for the AFTOC. The

resources of the AFTOC could be used to develop the implementation plans for those other recommended solutions.

Other Recommendations

Four technical order acquisition related topics should be included in the implementation planning for the solutions recommended above. Those four topics are:

1. Technology advances.
2. Validation/verification.
3. Insuring that technical orders arrive in the field with the equipment.
4. Relative priority of technical orders in the system acquisition process.

Technology Advances. Technological advances could have a significant impact on technical order acquisition in the future. Automation of technical orders, technological sophistication of future weapon systems, and technological improvements to equipment used in the system acquisition process could all have an impact on the technical order acquisition process. Automated technical orders are a technological reality. Technological sophistication of future weapon systems could effect the maintenance and technical order support required for those systems. Technological advances in equipment used for development, planning, and control of the system acquisition process could effect future technical order acquisition requirements.

The technical order acquisition process should be prepared for any responsibility or procedure changes that

might result from technological advances. In order to be prepared for those changes, technical order acquisition personnel should be involved in the development of any technological advances that could affect the technical order acquisition process.

Personnel from the plans and programs division of the AFTOC should monitor research efforts that might result in technological advances. When technological advances are discovered that could have an impact on the technical order acquisition process, plans should be developed to prepare the technical order acquisition process for the changes that might result from those advances.

Automated technical orders are receiving considerable attention in the Air Force today. The technology for automated technical orders is available and being used by non-defense companies. Defining the future role of automated technical orders in the Air Force will be a complex task. That task should be accomplished through a detailed investigation of the need for automated technical orders. Researchers should be careful not to automatically assume that automated technical orders are needed just because the technology is available. The assessment of the need for automated technical orders should be based on the projected improvement to operational readiness or performance that can be expected, or on the projected cost savings that can be expected without reducing performance or readiness. This assessment should include a careful examination of wartime

requirements for technical orders. Automated technical orders will have reliability and maintainability costs and considerations associated with them that should be carefully evaluated.

Validation/Verification. The implementation plan for the solutions recommended in this research should address validation and verification problems. Two major problems associated with validation and verification were the amount of time available to accomplish those tasks, and the availability of the weapon system during the technical order validation and verification processes.

The establishment of technical orders as a separate product could have an impact on both validation/verification problems. If the contract specifically states that technical order validation and verification will be completed by a certain time, more of an effort might be made towards meeting the contractual responsibility. A penalty for not meeting that time limit might provide additional incentive to complete validation and verification on time.

The AFTOC field assistance division could help the SPOs insure that proper attention is given to validation and verification considerations throughout the system acquisition process. Another division of the AFTOC, the technical specialization division, could help solve these problems by providing specialized assistance to the SPOs. In addition, the AFTOC plans and programs division could help by ensuring that the recommendation for the establishment of technical

orders as a separate product is properly implemented. This division could also research validation and verification problems in an effort to identify other potential solutions to those problems.

The Air Force Operational Test and Evaluation Center (AFOTEC) provides technical order validation and verification assistance to the SPOs. Inputs from that organization should be included in any investigation into this problem.

Obtaining Technical Orders on Time. Technical orders may not always be completed when the equipment that they support is delivered. When this happens, it is usually a result of the planners not allowing enough time to develop, validate, and verify technical orders.

The actions of the AFTOC and the establishment of technical orders as a separate product could help solve this problem. The implementation plans for the AFTOC and for the establishment of technical orders as a separate product should address this problem.

Priority of Technical Order Acquisition. When a program manager considers critical factors of cost and schedule that might prevent his system from reaching completion, technical orders are not generally a factor. As a result, technical order acquisition has a relatively low priority in system acquisition. However, system acquisition managers should insure that technical order acquisition is given enough priority to allow for the timely acquisition of

accurate and complete technical orders. Of the 130 respondents interviewed in this research, 14% indicated that the relatively low priority of technical order acquisition within the system acquisition process was the most significant technical order acquisition problem.

The establishment of technical orders as a separate product could help raise the priority of technical orders by making them a separate contractual obligation.

The AFTOC could also help increase the priority of technical orders within the SPOs through the increased technical order acquisition assistance that it could provide to SPO personnel.

The implementation plans for the AFTOC and for the establishment of technical orders as a separate product should address this problem.

Chapter Summary

The implementation of the five recommended solutions identified in this research was recommended. An integrated implementation plan for those recommended solutions was also presented. The establishment of the Air Force Technical Order Center was the key to that recommended plan. The requirements for the implementation of the other recommended solutions will be affected by the final implementation plan selected for the AFTOC.

The AFTOC should have responsibility for plans and programs for the technical order acquisition process. It

should include technical specialists, and it should provide field assistance to the SPOs.

The need to consider technological advances, validation and verification problems, timing of technical order delivery, and technical order acquisition priority while developing implementation plans for the five recommended solutions was also discussed.

These recommendations are offered as a starting point for improving the technical order acquisition process. They should be considered by policy makers and planners, but should not be implemented without further research.

Appendix A: Telephone Interview Schedule

Introduction: Good morning/afternoon. I am Capt _____, a graduate student at the AF Institute of Technology. I am doing research concerning the TO acquisition process, and you can help. You were asked to participate because of your position as [CTOM/PM/DPML/TOM]. Your responses to my questions will be kept anonymous, and will be combined with the responses of others in positions similar to yours. The purpose of my research is to learn more about the TO acquisition process, and your candid responses will help me do this. Please consider only the acquisition process for new systems when giving your responses. Do you have any questions before we begin?

1. What do you think is the largest single problem with the TO acquisition process as it is today?
2. If you could make one change within the TO acquisition process, what would that one change be?

The following questions are related specifically to the areas of interest in our research. Due to our method of gathering statistics for the following questions, we need a "yes" or "no" answer; however, please feel free to add to or embellish any answer as I am taking notes on your comments.

3. Do you think planning for TOs begins early enough in the acquisition cycle?
4. Do you think that coordination and communication between all agencies involved in the TO acquisition process for new systems is adequate?
5. Do you think the manpower dedicated to TO acquisition is adequate?
6. Do you think the training and assistance that TO acquisition personnel receive is adequate?
7. Do you think the establishment of a centralized AF TO management center will improve the TO acquisition process?
8. Do you think that the development and use of "skeleton" Statement of Work (SOWs), Requests for Proposals (RFPs), and contracts will significantly help TO acquisition personnel?

9. Do you think if TOs were treated as a "product" to be included as a separate line item in the SOW, RFP, and contract, that the TO acquisition process would be improved?
10. Do you think a handbook identifying coordination and cooperation responsibilities would aid TO acquisition personnel?
11. Do you think that a separate specific career field for TO acquisition managers would aid the TO acquisition process?

This ends the structured portion of the interview. Do you have anything you wish to add?

EXTRA NARRATIVE FOR INTERVIEWS WITH DPMLS:

In doing this research we were provided with your name, and the names of other DPMLs. To complete our research, we will also speak to Program managers and TO Managers; however, our information on their specific names and phone numbers is not exact. Would you help us further by providing the name and phone number of your PM, and the same information for your TOMAs, or those personnel working for you specifically responsible for TO acquisition? Again, your responses to our questions are confidential and will not be discussed with other respondents. We will ask them the same questions we have just asked you.

Thank you very much for your assistance. Good day!

Appendix B: Question One Responses

CTOM Responses

- there is not enough understanding/training/education
- the process is not done soon enough
- there is no centralized OPR (top mgmt) to supervise decentralized process
- TO requirements are not identified to contractors
- there is a lack of senior officer mgmt attention
- there is a lack of control by acquiring agencies
- there is no centralized downward mgmt: split mgmt
- there is a lack of education
- there is a lack of staff organization
- there is a lack of TOMA expertise in new SPOs
- the contract structure is poor: specs bad

PM Responses

ASD

- TOs are not getting into field with equipment
- validation/verification is late/bad
- focus is on wrong objectives: is process instead of user oriented
- money is often cut: we are not buying right stuff
- commercial data is not coupled with AF needs
- ALC knows needs, but getting 'word' to contractor is difficult
- time required to get TOFCNs processed is excessive
- TOs are not written to cover subject: milspecs are bad
- confusion exists because different services buy separate formats
- SPOs are not manned properly
- TOs are not out in time
- this is a creative field, and we don't control who enters

ESD

- timing: TOs get out too late for maintenance use
- documentation requirements are cumbersome

AD

- there are difficulties between organizations

BMO

- the hardware changes often, causing delays

DPML Responses

ASD

- TOs do not get into field for ver. before maint. uses them
- there is a lack of understanding of commercial TOs
- the TCTO process is bad
- too much time is required to develop, val/ver, etc., especially with concurrency
- funding is low: there are difficulties with scoping the TO down ie: use commercial or milstd?
- it is difficult to find qualified TO writers
- it is difficult to deal with the magnitude of entire effort, satisfying all requirements
- it is difficult to definite specific, vs generalized requirements
- the people who do the work lack experience
- achieving timely delivery of TOs with equipment is difficult
- the process doesn't get as much emphasis as it deserves
- it is difficult to insure data is available for TOs and on time
- there is not enough serious consideration early in process
- verification is not adequate
- PMRT causes problems
- acquiring vendor manuals is difficult
- there is a lack of qualified TOMAs
- there is no identification or establishment of coord. between gov. & contractor (monolithic mentality)
- it is difficult to 'cost' the tech data & val/ver inadequate
- personnel do not have enough experience
- val/ver is bad

ESD

- the ALC is unable to handle commercial products
- it is difficult to figure out costing data
- manpower limitations prevent development of functional experts
- the contractor does not know AF TO acquisition process
- people are not properly trained
- it is difficult to determine how much they should do & cost: "inefficient as all get-out"
- the process takes too long
- cost is high, timing with equipment in the field is poor

- it takes too long to create a TO and the inability to use commercial TOs
- there is no solid maint. concept at the outset, and LSA fails to drive TO development
- the schedule for getting hardware & TOs does not match
- timing with equipment in field is bad
- preplanning the cost of data and TOs is difficult
- hardware design changes too frequently
- the time frame of getting drawings from contractor is bad
- there are difficulties with acquisition of commercial data: changes are difficult
- the timing with equipment in field not good
- the review by using and supporting commands prior to use is inadequate

AD

- personnel do not understand, or are unable to evaluate, contractors capabilities
- it costs too much money for what we're getting
- there is a lack of definite procedures to acquire TOs
- the process is too slow: then is not initially correct
- there is a lack of trained people
- because LSA & LSAR are not fully on line yet, manning is too low for proper support
- there is no DOD standard

BMO

- it is difficult to determine up front what is needed
- everything written today refers to aircraft
- there is too fine a line between starting too early and not early enough

TOMA Responses

ASD

- the emphasis is on equipment, can do support later
- it is difficult to get TOs verified by AF
- there is a lack of good direction
- getting TOs to field at same time as equipment is difficult
- milspecs are outdated, not real-world
- there is no continuity in TO acq. man. career field
- funds are inadequate
- the funding up front is not realistic
- there is a lack of qualified people
- personnel are unable to find answers to questions
- management structure lacks problem solvers

- TOMA training is inadequate
- the milspecs are outdated
- there is no centralized acq. man. body to help SPOs
- there is no unified approach by AF
- TOs are not considered until last item
- policy setters have no TOMA experience
- TOs start too late in process
- TOs are non-standardized
- there is no automated tracking system available to TOMA
- TOMAs come into ASD without 'staff' experience
- there is a lack of qualified people that know requirements
- the method by which we release data (the form) is poor
- how we do business is not standardized: guidance is too generalized
- there is a lack of money for support equipment
- knowledge of data requirements by those acquiring TOs is inadequate
- TOs do not get verified in required time

ESD

- there is usually no maintenance plan up front
- there is confusion with milspecs over whether all requirements are applied
- there is a lack of manpower
- time constraints are too tight: not enough available for val/ver, etc.
- there is a difference of opinion between AF and contractor as to what is a valid IPR
- it is difficult to get contractor to comply: no leverage available to TO manager
- not enough time is allowed for val/ver
- doing process on both Military and commercial TOs is difficult
- there is a lack of coord. between various organizations and the people involved
- the process is too complex
- contractors do not get good guidance from PM office
- players change too often: same people don't go to meetings
- difficult to maintain currency with the equipment changes
- configuration control is bad: manual doesn't look like the equipment
- not everyone is properly trained
- there is a lack of TDY funds by ALC
- normal process is okay: problems occur when TO need is accelerated

AD

- there is no continuity of expertise
- there is no centralized control over AF TOs
- the majority of PMs & logisticians don't listen to TOMA
- milspecs are poorly written as guidelines, not standards

- there are too many governing regs and rules
- TOMAs have little authority to make decisions
- there is no training for personnel

BMO

- the equipment is not baselined soon enough
- it is difficult to keep the TO matched to the actual equipment

Appendix C: Question Two Responses

CTOM Responses

- we need to develop automated/realtime capabilities
- TOs should be considered earlier in the process
- need a permanent/full spectrum centralized mgmt
- should fund TOs and line items together, but as separate line items
- there should be dedicated manpower
- there should be a centralized agency
- we should centralize policy/mgmt
- there should be less centralization
- there should be dedicated manpower
- there should be dedicated manpower
- we should change directives & contract requirements

PM Responses

ASD

- do something to get TOs to field same time as equipment
- val/ver should be improved
- we should cause the system to focus on user, not process
- increase the nucleus of knowledgeable people
- improve user flexibility: reliance on milspec is a crutch
- simplify the process
- expedite the TOFCN process
- let TOs be developed by subject, by contractor
- have better manning: use technical types for val/ver, etc.
- require more training for TOMAs and get more semanticists and learning psychologists

ESD

- improve TO timing with field use of the system
- make sure TO development is closely tied to system development

AD

- form a centralized agency and standardize

BMO

- press for discipline on weapon [engineering] side

DPML Responses

ASD

- find a way to shorten time required for publication
"try to maintain continuity in a closed-loop system"
- form a centralized agency
- computerize the TO and TCTO process
- form a centralized agency
- develop TOs earlier in the process
- contract for the acquisition process itself
- delay writing TOs until the system is baselined
- simplify coordination between agencies
- use overall engineering data bank for design of TOs
- get more knowledgeable people working the process
- identify problems early enough to allow fixes
- should have early verification
- ensure the user provides equipment for val/ver
- clarify early what constitutes formal transfer from ASD to AFLC
- increase the number of TOMAs
- establish common requirements: one voice from government
- use more representative people in val/ver
- keep people correctly trained so they can do the job correctly
- improve coordination of equipment development and TO development

ESD

- allow for development of commercial manuals on a separate track
- insist on use of system that is AF std, not company specific
- create a functional specialist on TOs
- get a better handle on number of TO requirements
- automate process
- automate all TOs: allow one terminal instead of TO kit
- combine LSA with TO construction
- keep the books in preliminary status longer to allow corrections
- make the contractor responsible for updates & false info damages
- delete the milspecs
- shorten the time between val/ver and final distribution to field
- improve the identification of TO requirements
- get logistics more involved in engineering
- move toward Army 'NEWLOOK' (picture intensive) system
- use commercial off-the-shelf equipment data

- combine validation and verification
- maintain user-type experience in offices for review process

AD

- find better qualified sources
- identify where hard copies are necessary
- should use trained, knowledgeable people to deal with contractors
- automate entire process so changes can be real-time
- improve process of getting TOs published (material mgmt)
- the process is working real well!
- develop a DOD standard

BMO

- write stricter contracts
- automate everything: change specs
- use knowledgeable people

TOMA Responses

ASD

- make contractor supply TOs with equipment or no money
- consolidate 'how-to' info in one book
- have verification earlier
- automate delivery of TOs
- provide continuity of personnel
- elevate TO function to that of others (2-letter office)
- have a larger interchange with industry methods
- develop one standard document for total process that can be tailored
- form a centralized agency
- form a centralized agency
- update milspecs to the level of today's technology
- form a centralized agency, plus improve training
- develop and identify a standard approach
- see that TOs are included up front in the process
- make TOs separate division under PM to increase recognition
- provide better guidelines on participants functions
- should be more enforcement of contract to reduce late deliveries
- find a way to attract qualified people to be TOMAs: CBPO could flag possible candidates
- make sure TOMAs have school, training, etc.
- TO manager should have field TO experience
- institute a way to electrically transmit data to user

- make TO part of LSA automated, on-line system at SPO, cont., ALC, & MAJCOM
- add emphasis: all TOs for a system should be available with mission equipment
- streamline printing/distribution/changing procedures

ESD

- have a maintenance plan early
- use of AFADS should be clarified, then try process again
- provide more manpower on job
- allocate more manpower to Tech Data organizations
- have a more detailed verification effort
- find a way to make contractor comply
- change printing requirements from negatives to std 8.5x11
- keep 'TO team' together vice different people each meeting
- find a way to get contractor to agree to prices
- clean up CDRLs & AFADS: perhaps simplify
- introduce pre-guidance, have less structure
- pare down or consolidate milspecs
- simplify the process
- monitor process more closely: do better job of verification
- update milspecs: paying for much unneeded info
- make reviews mandatory by ALC, and include safety reps

AD

- develop a system to track people with TO acq. experience
- develop a responsible local and staff management
- should buy manuals, not TOs
- form a centralized agency under Air Staff
- consolidate the guidelines
- increase training for personnel
- delegate more decision authority to TOMAs

BMO

- streamline the ordering process: perhaps use computers
- improve interface between test people and TO people

Appendix D: Program Manager Responses

Division		Questions								
		3	4	5	6	7	8	9	10	11
ASD	Yes	11	6	8	3	4	10	10	9	5
	No	2	7	5	6	8	3	3	4	8
	% Yes	84.6	46.2	61.5	23.1	30.8	76.9	76.9	69.2	38.5
ESD	Yes	0	0	0	0	1	2	2	2	2
	No	2	2	2	2	1	0	0	0	0
	% Yes	0	0	0	0	50.0	100	100	100	100
AD	Yes	0	0	0	0	1	1	1	1	0
	No	1	1	1	1	0	0	0	0	1
	% Yes	0	0	0	0	100	100	100	100	0
BMO	Yes	1	1	1	-	1	1	1	1	1
	No	0	0	0	-	0	0	0	0	0
	% Yes	100	100	100	-	100	100	100	100	100
Total	Yes	12	7	9	4	8	14	14	13	6
	No	5	10	5	8	9	3	3	4	11
	% Yes	70.6	41.2	52.9	23.5	47.1	82.4	82.4	76.5	35.3

Appendix E: Deputy Program Manager for Logistics Responses

Division		Questions								
		3	4	5	6	7	8	9	10	11
ASD	Yes	13	9	5	3	13	17	19	17	15
	No	8	12	16	18	8	4	2	4	6
	% Yes	61.9	42.9	23.8	14.3	61.9	81.0	90.5	81.0	71.4
ESD	Yes	12	7	5	4	6	13	16	13	6
	No	6	11	13	14	12	5	2	5	12
	% Yes	66.7	38.9	27.8	22.2	33.3	72.2	88.9	72.2	33.3
AD	Yes	5	0	2	1	5	7	7	7	5
	No	2	7	5	5	2	0	0	0	2
	% Yes	71.4	0	28.6	14.3	71.4	100	100	100	71.4
BMO	Yes	1	1	1	0	0	1	3	3	2
	No	2	2	2	3	3	2	0	0	1
	% Yes	33.3	33.3	33.3	0	0	33.3	100	100	66.7
Total	Yes	31	17	13	8	24	38	44	40	28
	No	18	29	36	40	25	11	4	9	21
	% Yes	63.3	34.7	26.5	16.3	49.0	77.6	91.8	81.6	57.1

Appendix F: Technical Order Manager Responses

Division		Questions								
		3	4	5	6	7	8	9	10	11
ASD	Yes	13	4	1	5	21	23	25	24	21
	No	14	23	26	22	6	4	1	3	6
	% Yes	48.1	14.8	3.7	18.5	77.8	85.2	92.6	88.9	77.8
ESD	Yes	13	5	6	6	9	14	14	13	10
	No	4	12	11	11	8	3	3	4	7
	% Yes	76.5	29.4	35.3	35.3	52.9	82.4	82.4	76.5	58.8
AD	Yes	2	1	3	0	6	4	7	4	.5
	No	5	6	4	7	1	3	0	3	2
	% Yes	28.6	14.3	42.9	0	85.7	57.1	100	57.1	71.4
BMO	Yes	2	1	0	0	2	2	2	2	2
	No	0	1	2	2	0	0	0	0	0
	% Yes	100	50.0	0	0	100	100	100	100	100
Total	Yes	30	11	10	11	38	43	46	43	38
	No	23	42	43	42	15	10	4	10	15
	% Yes	56.6	20.8	18.9	20.8	71.1	81.1	90.6	81.1	71.7

Bibliography

1. Murone, Vince, Chief, Reports Division. Telephone interview. AFISC/SER, Norton AFB CA, 23 February 1984.
2. Hatterick, Richard G. and Harold E. Price. Technical Order Managers Reference Data: Final Report, 1 May 1978-1 May 1980. Contract F33615-78-C-0016. Air Force Human Resources Laboratory, Wright-Patterson AFB OH, May 1981 (AD-A099 779).
3. Chenzoff, Andrew P. Evaluative Study of the Content and Display of New and Existing Technical Data To Support Air Force Maintenance: Interim Report. Contract F33615-71-C-1734. Applied Science Associates, Inc., Valencia PA, November 1973 (AD-915 233).
4. Kirsch, Maj John P. Technical Order Acquisition Policy. Unpublished report no. 1430-81. Air Command and Staff College, Maxwell AFB AL, 1981 (AD-B057 734).
5. The Deputy Secretary of Defense. Memorandum for Improving the Acquisition Process. Washington DC, 30 April 1981.
6. Air Force Logistics Management Center. U.S. Air Force Centralized Technical Order Management Group Executive Committee Meeting Minutes. Gunter Air Force Station AL, 14-15 June 1983.
7. Winters, John T., Defense Material Specifications and Standards Office. Personal interview. Office of the Under Secretary of Defense Research and Engineering, Falls Church VA, 17 November 1983.
8. Air Force Acquisition Logistics Division, Air Force Logistics Command. AFALD Lessons Learned Bulletin. Wright-Patterson AFB OH, February 1982.
9. Williams, Herman and Arthur B. Winn. A Correlation Between the Assignment of Personnel to Technical Order Validation/Verification Versus Technical Order Deficiency Forms Generated. MS thesis, LSSR 22-80. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFBB OH, June 1980 (AD-A087 090).
10. Thomas, Donald L. and others. Opinions of Air Force Maintenance Personnel About Conventional Technical Orders: Final Report, 1 June 1974-1 March 1978. Project 1710. Air Force Human Resources Laboratory, Wright-Patterson AFB OH, July 1978 (AD-A058 340).

11. Spiers, Col Joe, USAF, Vice Commander. Personal interview. Air Force Acquisition Logistics Center, Wright-Patterson AFB OH, 25 January 1984.
12. Stiegmann, Wilton. HQ USAF/LEYE, Chairperson, USAF Centralized Technical Order Management Executive Committee, Washington DC. Personal interview. 17 November 1983.
13. The Deputy Secretary of Defense. Memorandum for Guidance on the Acquisition Improvement Program (AIP). Washington DC, 8 June 1983.
14. Air Force Logistics Command and Air Force Systems Command. Acquisition Logistics Management. AFLC/AFSC Pamphlet 800-34. Andrews AFB Washington DC, 1981.
15. Peterson, Ray J. OO-ALC/MMEDT, Letter to USAF Centralized Technical Order Management Group Executive Committee. Headquarters Ogden Air Logistics Center (AFLC), Hill Air Force Base UT, 9 September 1983.
16. Air Force Logistics Management Center. U.S. Air Force Centralized Technical Order Management Group Executive Committee Meeting Minutes. Gunter Air Force Station AL, 16-27 July 1983.
17. Brown, Capt Thomas D., Jr. U.S. Air Force Centralized Technical Order Management Group Executive Committee meeting. Personal meeting notes. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, 15 and 16 November 1983.
18. Munguia, Arthur A., Course Director, Technical Order Acquisition Management Course. Personal interview. Air Force Institute of Technology, Wright-Patterson AFB OH, 17 November 1983.
19. Barnett, Lt Col Vic, USAF, T-46A System Program Director. Personal interview. ASD/AF, Wright-Patterson AFB OH, 30 August 1983.
20. Hatterick, Richard G., and Harold E. Price. "Technical Order Management and Acquisition." Unpublished technical report, AFHRL-TR-80-50, Air Force Human Resources Laboratory, Air Force Systems Command, Brooks AFB TX, May 1981.
21. Air Force Systems Command. Acquisition Management. AFSC Pamphlet 800-3. Andrews AFB Washington DC, 1978.
22. Air Force Logistics Command. Logistics Management Policy. AFLC Regulation 400-1. Wright-Patterson AFB OH, 1978.

23. U.S. Department of the Air Force. Integrated Logistics Support (ILS) Program. AF Regulation 800-8. Washington DC, 1980.
24. Air Force Acquisition Logistics Division, Air Force Logistics Command. DPML/ILSO Responsibilities and Management Indicators. AFALD Regulation 800-2. Wright-Patterson AFB OH, 1978.
25. Carwise, Capt Edward R., USAF, and Lt Richard L. Bemrose, USAF. "A Proposal for Improving AFSC Management of Technical Publications." MS thesis, SLSR-9-67, AFIT/SL, Wright-Patterson AFB OH, August 1967 (AD-825 201).
26. Naval Air Systems Command. Policies and Responsibilities For the Naval Air Systems Command Technical Manual Program. Navair Instruction 5600.20B. Washington DC, 1982.
27. Air Force Logistics Management Center. U.S. Air Force Centralized Technical Order Management Group Executive Committee Meeting Minutes. Gunter Air Force Station AL, 16 and 17 November 1982.
28. Emory, C. William. Business Research Methods (Revised). Homewood IL: Richard D. Irwin, Inc., 1980.

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SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED			1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE				
4. PERFORMING ORGANIZATION REPORT NUMBER(S) AFIT/GLM/LSM/84S-6			5. MONITORING ORGANIZATION REPORT NUMBER(S)	
6a. NAME OF PERFORMING ORGANIZATION School of Systems and Logistics		6b. OFFICE SYMBOL (If applicable) AFIT/LS	7a. NAME OF MONITORING ORGANIZATION	
6c. ADDRESS (City, State and ZIP Code) Air Force Institute of Technology Wright-Patterson AFB, OH 45433			7b. ADDRESS (City, State and ZIP Code)	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION		8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS (City, State and ZIP Code)			10. SOURCE OF FUNDING NOS.	
11. TITLE (Include Security Classification) See Box 19			PROGRAM ELEMENT NO.	PROJECT NO.
			TASK NO.	WORK UP NO.
12. PERSONAL AUTHOR(S) Thomas D. Brown, Jr., B.B.A., Captain, USAF Dennis R. Lyon, B.A., Captain, USAF				
13a. TYPE OF REPORT MS Thesis	13b. TIME COVERED FROM _____ TO _____		14. DATE OF REPORT (Yr., Mo., Day) 1984 September	15. PAGE COUNT 125
16. SUPPLEMENTARY NOTATION Approved for public release by AFM 278 128-12. 14-568887 Don for Research and Professional Development Air Force Institute of Technology, AFIT (Include Security Classification)				
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse (If necessary) identify by block number)	
FIELD 05	GROUP 02	SUB. GR.	Acquisition, Procurement, Government Procurement Military Procurement, Air Force Procurement	
19. ABSTRACT (Continue on reverse if necessary and identify by block number) Title: UNITED STATES AIR FORCE TECHNICAL ORDER ACQUISITION: WHAT ARE THE PROBLEMS AND HOW CAN THEY BE CORRECTED? Thesis Chairman: Arthur A. Munguia, GS-12				
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED <input checked="" type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS <input type="checkbox"/>			21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED	
22a. NAME OF RESPONSIBLE INDIVIDUAL Arthur A. Munguia, GS-12		22b. TELEPHONE NUMBER (Include Area Code) 513-255-3355	22c. OFFICE SYMBOL AFIT/LSY	

DD FORM 1473, 83 APR

EDITION OF 1 JAN 73 IS OBSOLETE.

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SECURITY CLASSIFICATION OF THE

The objective of this research was to identify problems with the acquisition of U. S. Air Force technical orders (TOs), and to identify changes to the TO acquisition process that could solve those problems.

The objective was accomplished through a telephone survey of AF policy makers, Program Managers, Integrated Logistics Support managers, and TO acquisition managers.

The results of the telephone survey indicate that the low experience level of personnel assigned to TO acquisition responsibilities, and coordination/communication problems were the most significant problems with the TO acquisition process. Inadequate manning and the lack of early planning for TO acquisition were also found to be problems.

Five identified solutions to those problems were found to be valid and were recommended for implementation. They are the establishment of a centralized TO management agency, treatment of TOs as a separate product during weapon system acquisition, the use of "skeleton" documents, the development of a handbook outlining responsibilities, and the establishment of a separate career field for TO acquisition managers. The establishment of a centralized TO management agency was found to be the most needed solution. A recommended implementation plan was presented for each solution.